# The Heating Ventilating Magazine

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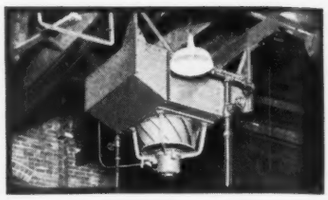

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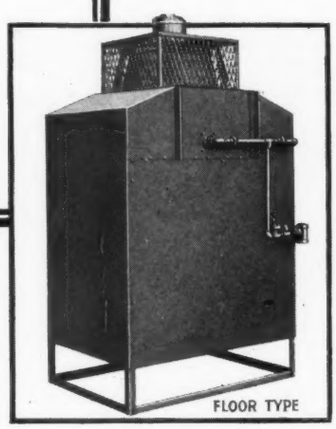


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# The Heating and Ventilating Magazine

VOL. XXIV

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No. 9


## Contents for September, 1927


**Sectional Control of Variable Steam Pressure** ..... *Harold L. Alt* **65**
Consideration of Various Methods of Dividing a Building to Secure Highest Operating Efficiency.

**A Method of Calculating Radiation for Intermittent Heating** ... *Charles F. Wolfsfeld* **70**
"Responsivity" of Interior Walls and Floors Introduces Important Factors that Should Not Be Neglected.

**Facing the Facts** ..... *P. E. Fansler* **74**
Aftermath of "Some Thoughts on the Combustion of Oil Fuel" Brings Out Vital Points.

**Another Ventilation Competition** ..... **76**
$150 in Prizes for the Best Designs for a Small Moving-Picture Theatre.

**Pipecraft** ..... **78**
VIII—Connections for Boilers in Batteries, Connections to Return Tappings, Return Connections on Several Boilers, Connecting Hot Water Tanks, Hot Water Tanks on Vacuum Systems, Vacuum Steam Connections for Indirect Stacks.

**A Study of Steam Control in an Intermittently-Heated Office Building** ..... *William J. Baldwin, Jr.* **81**
How Graphic Analysis of Steam Consumption Checks with Actual Performance.

**A Floor-Coil Heating System** ..... *William Sommer* **82**

**New Home-Study Course in Gravity Steam and Water Heating** .. *Ara Marcus Daniels* **85**
Lesson No. 26—Ratings of Steam and Water Boilers.

**Formulating the Boiler Code** ..... **91**
Report of A.S.H.&V.E. Committee Tells What Factors Were Considered Paramount, and Why.
Letters From Four Sources Express Divergent Opinions and Embody Relevant Suggestions.

**Gas Heats Large Buildings** ..... **96**
Office and Public Buildings and Apartments Form New Field With Radiation Loads Up to 40,000 Sq. Ft.

**Gas Industry Accepts Boiler and Furnace Code** ..... *Eugene D. Milener* **99**
A.G.A. Testing Laboratory Busy Rating Gas-Heating Equipment on Comprehensive Performance and Construction Requirements Recently Adopted.

**Correspondence** ..... **101**
How Boiler Connections Should Be Made.
One-Pipe Versus Vapor for Oil or Gas-Fired Heating Systems.
Greasy Core Sand in Radiators.
Why the Far Radiator Does Not Warm Up on a Thermostatically-Controlled System.
Dry Versus Wet Returns.

**Solving the Oil-Burner Service Problem** ..... **104**
Various Practices Work Toward the Same End, But Uniform Methods Are Not Yet Established.

**Heating Plants as Fixtures** ..... *John Simpson* **107**
4. As Between Insured Owner and Insurance Company.
5. As Between Owner or Mortgagee and Conditional Seller of Plant.

**Health and Ventilation** ..... *Peter H. Bryce, M.D.* **109**
5. The Cooling and Ventilating of a Unit Dwelling.

**The Business of Contracting** ..... **111**
Part IV—Building Up a Cost System.

**Grates for Burning Small-Sized Anthracite** ..... **113**
11. Oxykol.

**Details Announced of Boiler and Radiator Merger** ..... **114**

**Power Show Plans Rapidly Rounding Into Shape** ..... **115**

**Committee D-2 Simplifies Domestic Oil-Fuel Classification** ..... **116**

**Oil Burners for Large Low-Pressure Heating Plants** ..... **125**
2. W. N. Best.

**Standard Heating and Ventilating Data Sheets** ..... **98A**
No. 20D—Air Conditioning—Dry-Bulb Temperature Rise.
No. 20E—Air Conditioning—How to Use Dry-Bulb Temperature Rise Chart.

**Engineers' Specification Index, Page 186.**

**Advertisers' Index, Page 194.**



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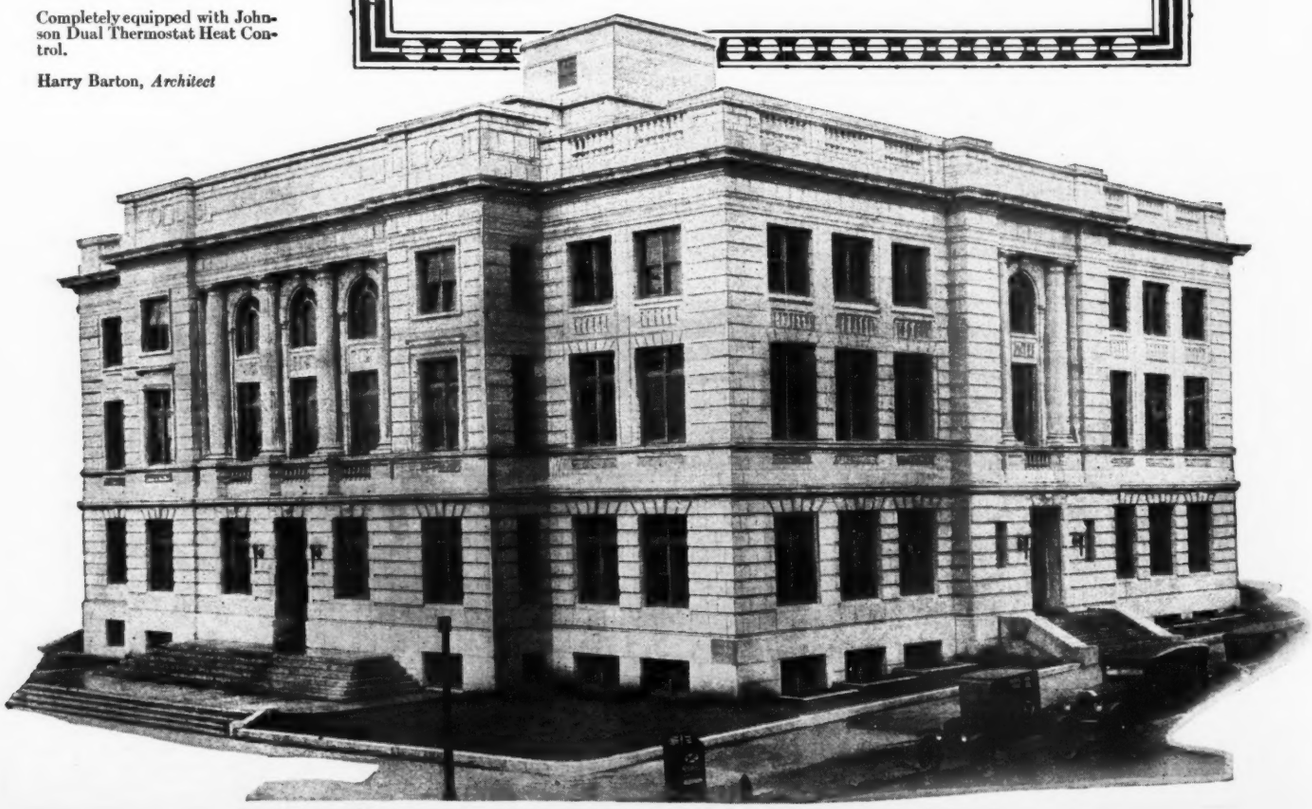


The Heating and Ventilating Magazine

*A Monthly Journal of Engineering Progress*

SEPTEMBER, 1927

# Sectional Control of Variable Steam Pressure

## Consideration of Various Methods of Dividing a Building to Secure Highest Operating Efficiency

*By Harold L. Alt*

WITH the increasing use of variable steam pressure in radiators to overcome mild-weather overheating effect which is now so common, it is important to remember that there is a right, as well as a wrong way of making this application. It is a generally-understood principle in this type of heating that the longer the system can be kept operating under very low pressures, i.e., vacuum of high degree, the greater will be the fuel economy. Therefore, to secure the greatest fuel saving, it is essential to design the heating system so as to operate its greatest portion, at the highest vacuum, the longest period of time, and still maintain comfortable temperatures in all parts of the building.

In order quickly to grasp the points brought out in this article, it is necessary to state that this discussion is limited to vacuum steam systems operating in large buildings, with the *steam pressures* in the *radiators* controlled from the boiler room—or at least from the basement—so that the pressure in the radiators can be varied at will from, say, 2 lbs. gauge to 22 in. or 25 in. of vacuum, thereby controlling the heat emitted from the radiators from normal down to about 50% of normal.

### VARIATIONS IN WINDAGE DETERMINE OPERATION OF SYSTEM

On still days, with the radiation properly proportioned, the vacuum on the entire building can be adjusted to suit the outside temperature, and satisfactory operation of the building as a whole will be attained. In this condition one vacuum pump could handle the whole job so long as the vacuum control was arranged so as always to keep a little higher vacuum on the return than in the steam supply line, in order to maintain circulation.

But suppose a strong wind were to spring up and blow on one or two sides of the building; the rooms exposed to the wind action would begin to grow cold even if the actual outside temperature remained exactly the same. Consequently, with a single vacuum pump, it would be necessary to reduce the vacuum on the whole building until the steam pressure rose in the radiators on the exposed sides of the building and their heat emission increased to a point where the increased heat would counterbalance the additional wind loss.

Considered from an engineering standpoint, this means that every time the wind blew it would be necessary to discard some of the possible fuel saving which otherwise might be obtained on the lee portion of the building. Now there are really very few absolutely still days in the winter season and even the still days are likely to have wind to some extent during a certain part of the 24 hrs. So the problem resolves itself into arranging the piping system so as to give the maximum amount of control—in other words, *sectional* control.

### SECTIONAL CONTROL

Sectional control is useless without a separate vacuum pump to allow differing vacuums to be carried on the various sections as required; also a separate reducing valve must be used so as to make the steam pressure to each section an absolutely independent proposition. Taken another way, each heating section is made into a clean-cut

and distinct heating system and has no connection with any other heating section, beyond securing a steam supply from a common high-pressure header. But how shall the piping be arranged so as to gain the maximum advantage possible?

### SYSTEMS SEPARATED ON AXIAL LINES

The simplest division of a building is usually along one of the axis lines; therefore this arrangement will be considered first. In Fig. 1 is shown a square which may be taken as a more or less basic form for all buildings, or sections of buildings. The top of the square is assumed as facing north which, of course, makes the right-hand side face east, the left-hand side, west, and the bottom, south, all as marked. It is assumed that the building is divided into two heating sections, or halves, along the north and south axes; the two heating sections may be designated as the east half and the west half.

With this arrangement there would be two feed mains, one main supplying steam to each half, and two return mains, one from each half. All the radiator risers on the east half would be supplied from the steam riser supplying that half of the building and all the return risers from the same radiators would connect into the return from that same half; similarly with the other side.

### PERCENTAGES OF WIND FROM EACH DIRECTION

Fig. 1 also indicates the eight directions into which the weather bureau divides the wind, these directions being marked, N., N.W., W., and so on; the percentages at the tail of each arrow represent the proportion of the number of days during the heating season that the wind was classified as blowing from the direction indicated by each arrow. These percentages are for New York City and were compiled from the Weather Charts published in THE HEATING AND VENTILATING MAGAZINE for the winter season of 1926-7, beginning October 15 and ending March 31.

Of course the wind does not always blow exactly as the arrow points; in fact, it may blow from any point in an arc of 45° of which the arrow indicates the middle. Counting up all the days during the heating season, it is found that for the last winter the percentage of days that the wind blew in each direction was as follows:

| Direction | Per cent |
|---|---|
| N. | 11 |
| N.W. | 35 |
| W. | 13 |
| S.W. | 13 |
| S. | 9 |
| S.E. | 2 |
| E. | 7 |
| N.E. | 10 |
| Total | 100 |

These percentages, as they represent the proportion of *days*, may be taken as also approximately representing the *amount of time* that the wind came from each eighth of the compass.

### EFFICIENCY PERCENTAGE POSSIBLE

Referring again to Fig. 1, it readily may be seen that, during mild temperatures when the steam pressure could be reduced on all radiators in still weather, if a wind started to blow, the pressure would have to be raised on the radiators on the windward side or sides. Now for a division on

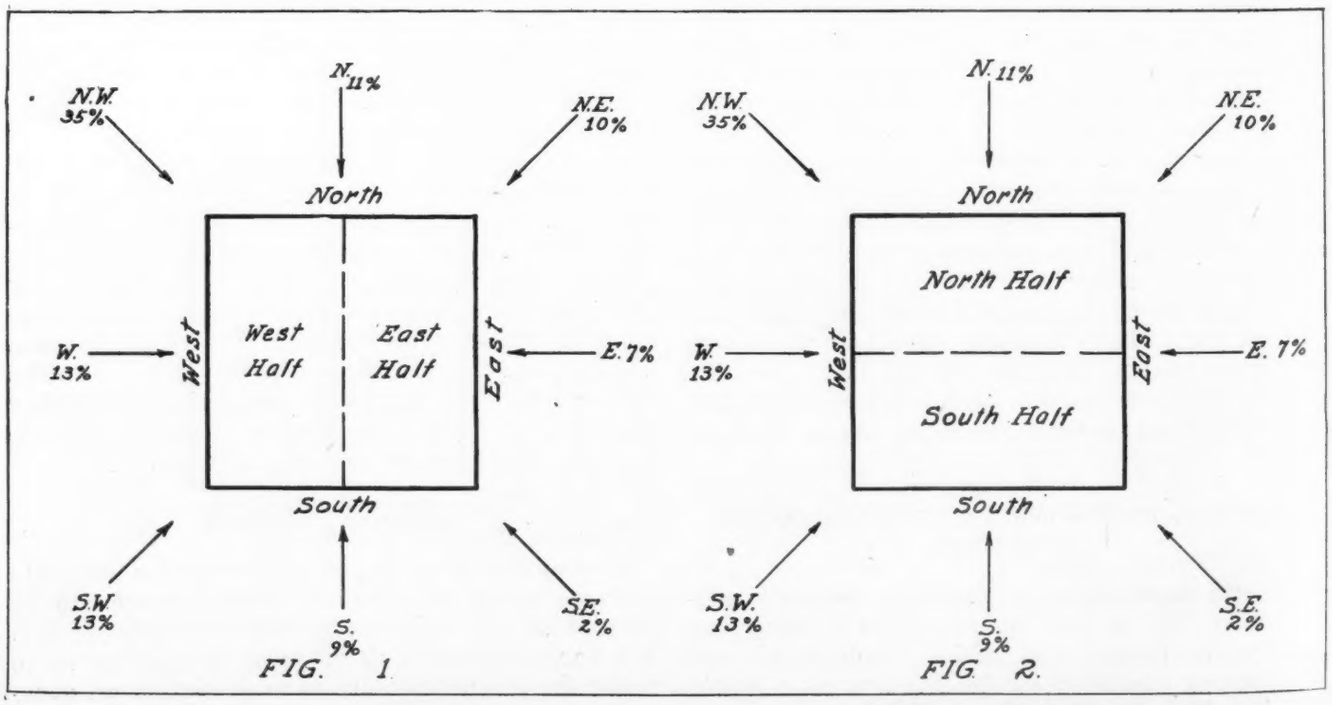



**Fig. 1. Wind Effect on Building Divided Into East and West Halves**

**Fig. 2. Wind Effect on Building Divided Into North and South Halves**

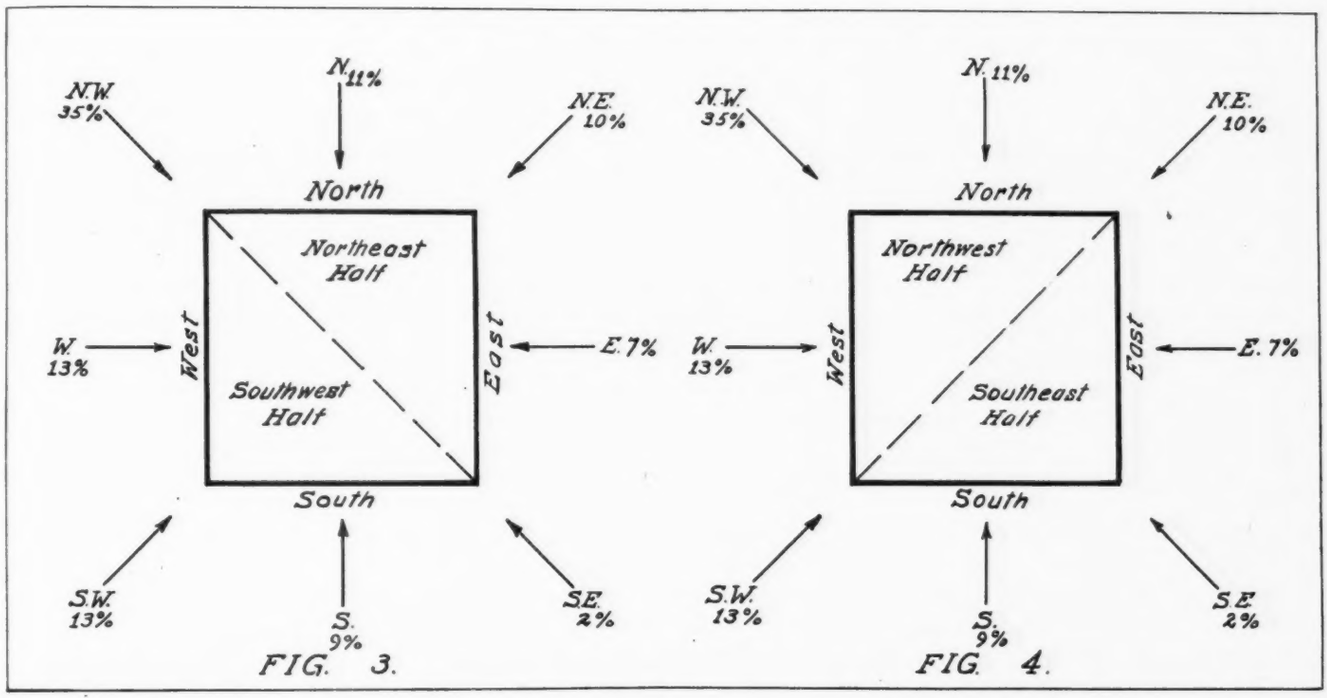



**Fig. 3. Wind Effect on Building with Diagonal Separation Line from Northwest to Southeast**

**Fig. 4. Wind Effect on Building with Diagonal Separation Line from Northeast to Southwest**

the north and south axis, as shown in Fig. 1, what does this mean?

It may be seen by studying the arrows that the only direction from which the wind could blow without requiring the raising of the steam pressure in both heating sections would be

East..... 7% of the time
West.....13% of the time

Total.....20%

In other words, during 20% of the winter season the wind would be in such a direction as to permit steam reduction on half of the building. This is equivalent to being able to lower the steam pressure on all of the building of 20% × ½ or 10%, which figure may be taken as an index of the desirability of such an arrangement of piping.

Proceeding to Fig. 2 an exactly similar scheme is shown except that the division has been made on the east and west axes, instead of the north and south, just considered. With this second scheme it will be seen that the only directions from which the wind can blow and affect one heating section only will be from the north and the south; all other directions will impinge on walls requiring the raising of the steam pressure on both sections to counteract. Therefore, the time when one heating section may be run at reduced pressure will be when the wind is from the

North .....11%
South ..... 9%

Total .....20%

This scheme is not a bit better, nor is it any worse, than the one given in Fig. 1.

DIAGONAL AND ALTERNATE DIAGONAL SEPARATION

But how about a diagonal division, what would this accomplish? A glance at Fig. 3 will indicate such an arrangement with the diagonal separation running from the northwest corner to the southeast corner. This divides the building into a northeast heating section and a southwest heating section, each section being half of the building, but of triangular shape, instead of oblong as before.

This scheme is seen at once to have advantages over the axial divisioning, as it will not only permit dropping the steam pressure in one half or the other for N., S., E., and W. winds but also permits similar treatment for N.E., and S.W. winds, making the percentages as follows:

N. .....11%
N.E. .....10%
E. ..... 7%
S. ..... 9%
S.W. .....13%
W. .....13%

Total .....63%

So, if half of the building may have the steam pressure dropped 63% of the time, this is equivalent to having the pressure lowered in the entire building for

63% × ½ or 31½% of the time.

This is not the best that can be accomplished with diagonal divisions, however, for a major portion of the winter winds in New York are from the northwest, and the arrangement shown in Fig. 3 is such that *both halves* will have to have the steam pressure raised to meet a northwest wind.

In Fig. 4 is given an exactly similar scheme to Fig. 3, except that the division is run from the

northeast corner to the southwest corner and this results as given below:

| | |
|---|---|
| N. | 11% |
| E. | 7% |
| S.E. | 2% |
| S. | 9% |
| W. | 13% |
| N.W. | 35% |
| Total | 77% |

for half of the building or 77% × ½ or 38½% for the whole building.

If a very large percentage of wind comes from any certain direction it is only natural to suppose that an arrangement meeting this special condition will be the one to be most efficient.

The various possibilities for two sections are now practically exhausted, and it has been demonstrated that the most efficient arrangement for a two-section or two-system scheme consists of a *diagonal division of the building with the diagonal running perpendicular to the direction of prevailing wind.*

### USE OF FOUR SYSTEMS

But suppose the building is big enough to warrant more than two divisions as are most buildings —then what?

Owing to the fact that the building has four sides, the proposition of three systems will not be considered as they would not work out symmetrically with such a condition; in a triangular-shaped building they undoubtedly would go well and produce some interesting calculations to determine the best method of sub-division. So the next possibility is the matter of using four pumps and four separate supply systems.

In Fig. 5 the building is shown divided into four quarters and this produces complications for, with a northwest wind it would be necessary to raise the steam pressure on the N.W., N.E., and S.W. quarters while with a west wind it would be necessary to raise on only the N.W. and S.W. quarters. In other words, under some conditions only one-quarter of the building could be operated under high vacuum while, under other directions of wind, half the building could be operated on low pressure, being on the lee side.

A careful study of the diagram shows that at no time could three-quarters of the building be run under high vacuum, but that half of the building could be kept down when the wind was from the north, south, east, or west directions and that one-quarter could be kept down when the wind is from any one of the four intermediate quarters, viz., N.E., S.E., S.W. or N.W. This gives percentages as follows:

| | | |
|---|---|---|
| ¾ reduced | | none |
| ½ reduced | | |
| | N. 11% | |
| | S. 9% | |
| | E. 7% | |
| | W. 13% | |
| | | 40% × ½ = 20% |
| ¼ reduced | | |
| | N.W. 35% | |
| | N.E. 10% | |
| | S.E. 2% | |
| | S.W. 13% | |
| | | 60% × ¼ = 15% |
| | Total | 35% |

This indicates that with this method, and using four different systems, the results will not be as good as were found with only two systems properly

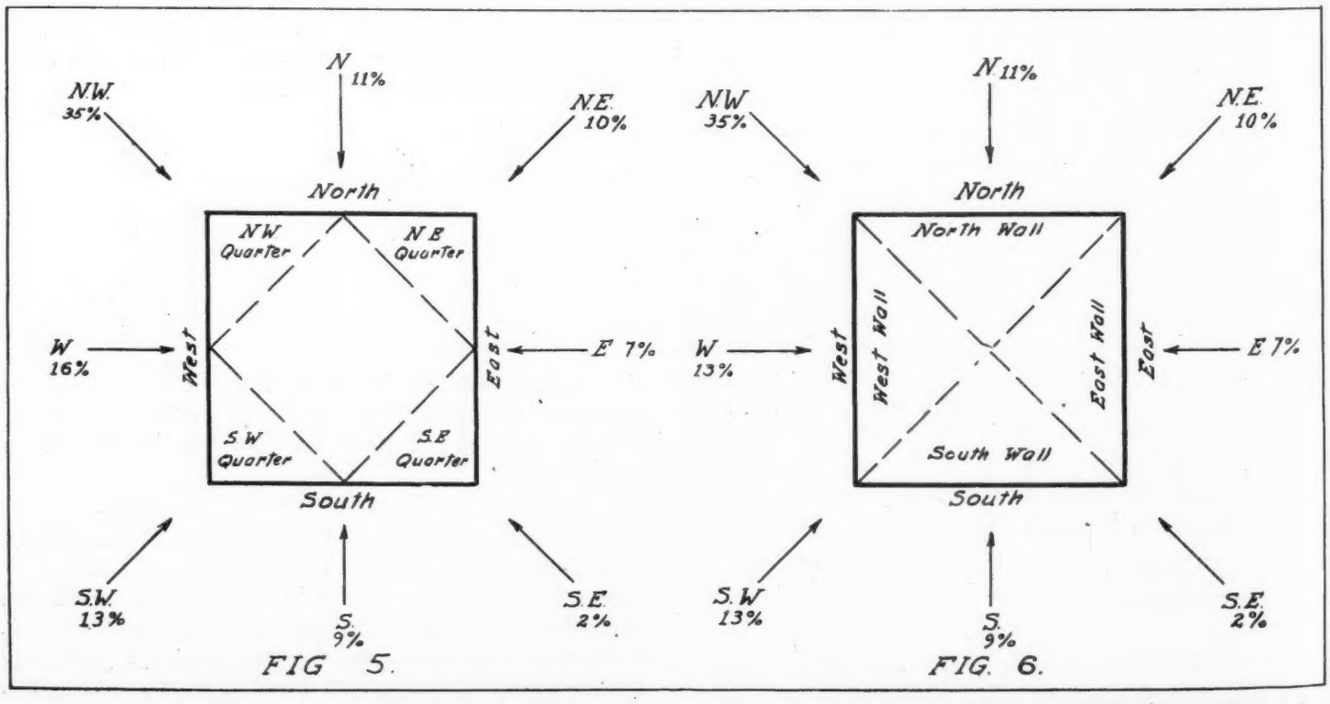



**Fig. 5. Wind Effect with Quarter-Section Scheme of Dividing Building**

**Fig. 6. Wind Effect When Each Wall Is Considered as a Separate Problem**

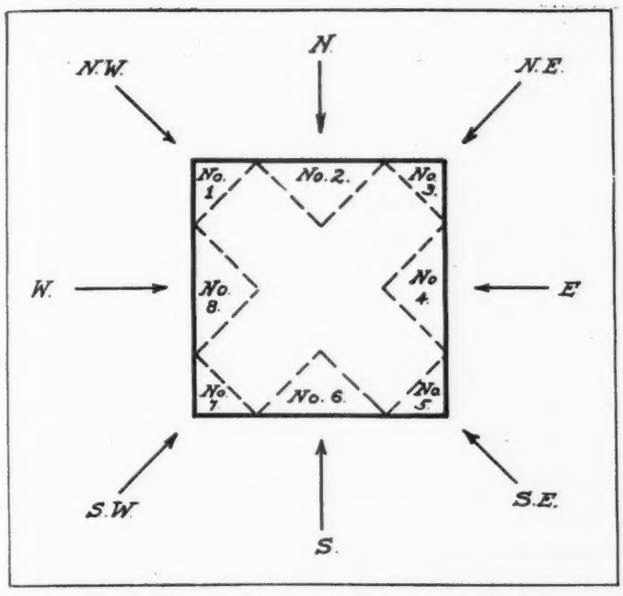



**Fig. 7. Wind Effect with One Division in Each Corner and One Division Between Each Two Corner Sections**

arranged as shown in Fig. 4 where 38½% was obtained.

Better results will be obtained if, instead of dividing the building into quarters, each wall is considered as a separate problem similar to the idea given in Fig. 6. Here the north side of the building has all the radiators on that side hooked up on one heating system, the east side on another, and so on for the four sides. Under these conditions three-quarters of the building will be in the lee for north, south, east or west wind and one-half for the balance of the directions, thus:

¾ reduced

N.....11%
S..... 9%
E..... 7%
W.....13%

40% × ¾.....30%

½ reduced

N.W....35%
S.E..... 2%
S.W.....13%
N.E.....10%

60% × ½.....30%

¼ reduced none

Total.....60%

A still further gain will be made if the building were set so as to have one wall facing the prevailing wind which, in this case, is northwest, the gain amounting to a little over 2%; as it is not customary to orient buildings with regard to facilitating the heating of same, this phase of the matter may be neglected. From the foregoing the principle may be deduced that the best results will be obtained with a four-section or four-system scheme *when the systems or sections are arranged so as to include one wall only.*

The increasing percentage of efficiency obtained with the larger number of systems might lead to the supposition that, if a still larger number of subdivisions were made, still higher efficiencies would result. Such, however, is not the case. This will be understood by attempting to use eight systems.

With eight divisions applied to the walls there would be two divisions to each wall and these two divisions would operate together as there is no difference in one part of the wall from the other; therefore the efficiencies would be the same as in Fig. 6. The only other arrangement would be as shown in Fig. 7, where one division is put on each corner and one division is placed between each two corner sections. Using, as before, the same methods in computing, the efficiency of this arrangement is only 47½%, or not nearly as good as some of the arrangements already secured with a lesser number of sub-divisions.

Sometimes special conditions may make a larger number of systems desirable, such as when a very high building may be well sheltered at the bottom, partially sheltered a good way up, and totally exposed near the top; a similar condition would exist if part of the side of a building were sheltered by an adjacent structure and the balance of the side entirely exposed to the wind.

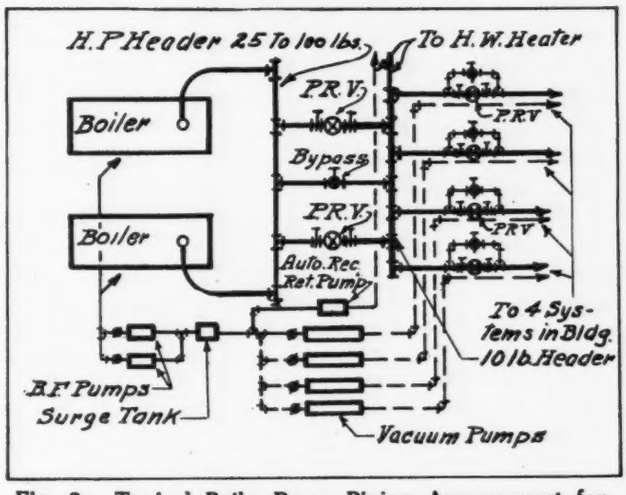



**Fig. 8. Typical Boiler-Room Piping Arrangement for Sectional Control of Variable-Pressure System**

### ARRANGEMENT OF BOILER PLANT

In the planning of separate heating systems to operate on varying steam pressures in the radiators, all that is necessary to do is to install a boiler plant to supply steam at any pressure from 25 lbs. gauge, up, and to put in reducing valves to feed a low-pressure header in which steam will constantly be carried at 10 lbs. gauge. From this header a supply to each system is taken through pressure-reducing valves and the returns from each system are brought back to their respective vacuum pumps. Such a layout is shown for a four-system installation in Fig. 8. From the vacuum pump the returns are handled in the usual manner and pumped back into the boiler with the customary boiler-feed pumps.

For hot water tanks it is best to run a separate line in order to use them in the summer without keeping the heating system piping hot and also to prevent their interfering with the pulley of a high vacuum on the heating system during the mild winter days.

# A Method of Calculating Radiation for Intermittent Heating

## "Responsivity" of Interior Walls and Floors Introduces Important Factors That Should Not Be Neglected

*By Charles F. Wolfsfeld*

PROBABLY no phase of heat-loss computations has received so little study by the heating engineer as that which concerns the absorption of heat by cold interiors. The heating engineer, in computing radiation, is chiefly concerned with coefficients of heat *transmission*. He is primarily interested in the heat that flows out *through* the walls and windows; in other words, the heat that is *lost*. He probably neglected to consider, with serious consequence, the heat that is *absorbed* by the cold walls, floors and partitions, when steam is turned into the heating system.

"The house was so cold this morning that it took all day to heat up!" is a common observation. Assuming that the heat-loss constants and computations for this house were absolutely correct for its particular construction and location, and assuming further that the weather upon which they were based would prevail indefinitely, the temperature in this house will remain *below* the desired point forever and a day! The cold interiors absorb heat as soon as the temperature of the room rises a single degree, and thereby steal some of the heat intended for replenishing the loss through the outside walls and windows.

### PERCENTAGE METHOD OF ALLOWING FOR INTERMITTENT HEATING IS ILLOGICAL

Conservative engineers in the past, finding no more accurate method, have considered this heat absorption in the popular way—the addition of percentages, which seemed to serve the purpose.

In handbooks and catalogs we find the advice, "For intermittent heating add 20% to the radiation." Some recommend 25%, 30%, and even higher percentages. The question then arises, "Which percentage shall we use for a one-family house which is heated 18 hrs. out of 24; for an office building that is unheated from Saturday afternoon to Monday morning; for a school building that may be unheated Christmas week; for a church that is heated in the morning and again at night?" The most casual reflection suggests that a building which remains unheated for a long period should be provided with more radiation for "starting" than one with shorter periods of non-operation. But why add a *percentage* of the radiation computed for transmission, when this radiation has absolutely no bearing upon the rate of interior heat absorption? This radiation affects only the rate of cooling.

A room may be 50 ft. in depth, and yet have an exposed wall only 10 ft. long. Another room may be half as deep with the same outside wall. The former would contain approximately twice as much area of interior walls and partitions as the latter, and the radiation necessary to provide for the usual heat losses, as commonly assumed, in either case may be the same. For these two rooms the "percentage" method would dictate the same amount of radiation for heat absorption in both cases, whereas twice as much heat would be absorbed in the first room as in the second. Why not, then, put the burden where it belongs? Ascertain how much heat is absorbed the first hour by each square foot of terra cotta partition, by each square foot of floor and ceiling, and by each cubic foot of air within the room.

In order to study this problem in a practical manner we might start with a building that has cooled down to 40°, for at 32° all plumbing, and heating pipes and fixtures would freeze and burst. If heat is turned on, the air in the room will be brought up to 70° in a definite time. It is assumed, of course, that the radiation is ample for this purpose. In this connection it is interesting to note that the air in the room will have to be heated in the event of no air infiltration, or it will have to be displaced by air heated to room temperature in case infiltration does occur.

It is quite possible, in the case of a large room with few windows, or with tight windows, that the radiation provided for infiltration would be insufficient for bringing the air within the room up to 70° in a reasonable time. In this event additional radiation will have to be allotted under the heading of "heat absorption" to make up the deficit.

### ANALYSIS OF A SIMPLE PROBLEM

Fig. 1 shows a typical 4-in. hollow-tile interior partition, plastered on both sides. The air within the room is being heated from 40° to 70°. We have a cold wall in warm air—what happens? Naturally the wall cools the air. The problem is, how much, and at what rate? Do cold walls mean a cold room?

We have seen or heard of the Eskimo huts—igloos—built of snow. It is generally understood that the air within these chilly walls can become comparatively warm. This fact is due to the variable capacity that the air has for absorbing heat. Air will absorb more or less heat, depending upon its rapidity of motion. The air in the snow hut

is confined to a small space, and harbors only minor convection currents. The result is a film of air at the surface of the wall, almost at rest, in which condition it conducts heat very slowly. If a room is small and low, it can be comfortably heated even with comparatively cold walls. As the size of the room increases, especially in height, moving currents of air at increased velocities cause a more rapid rate of absorption of heat.

Almost every one has observed how cold the walls of a room feel, even though the temperature may register 70°. Under ordinary conditions of heating up a room, we may say that the temperature at the surface of the walls lags behind the room temperature. Where the temperature of the air in

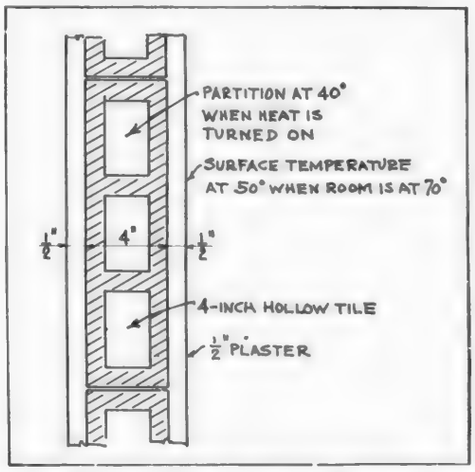



**Fig. 1. Temperature Conditions in Typical Interior Partition Construction**

the room is 70°, that at the wall surface may be 50° or less, depending upon the initial temperature and the period of time that has elapsed since the 70° temperature was reached. If the room temperature is maintained for a sufficiently long period, this lag will decrease in magnitude until the entire wall or partition (interior) assumes the temperature of the surrounding atmosphere.

The question before us is, "How much heat will 1 sq. ft. of an interior partition (4-in. hollow tile plastered) absorb during the first hour?"

### COMPUTING THE SATURATION TIME

In a previous discussion on "responsivity," a 4-in. hollow-tile wall plastered on both sides was given a responsivity time of 0.096 hrs., assuming 1 sec. for glass. The assumption in this regard was that a wind blowing upon the outside of the glass would produce a perceptible effect on the inner surface in *one second.* For the consideration of interior partitions, it will be assumed that a sheet of single-thick glass at a low temperature, if suddenly introduced into a warm atmosphere, will heat up to approximately the surrounding temperature in *fifteen seconds.* This is taken as the time required for complete heat saturation.

One of the most fascinating developments in formulating this theory of responsivity came when many mathematical calculations for concrete walls, ranging from 3-in. to 24-in. thickness, showed that the entire time required for total heat absorption was *exactly* 15 times the responsivity time of glass. It therefore seems reasonable to assume similar ratios for other homogeneous substances.

Upon this basis the saturation time for other forms of construction can be computed. For the 4-in hollow-tile partition in question, the saturation time would be fifteen times the responsivity time of 0.096 hrs., or 1.44 hrs. In other words, this entire partition would acquire the same temperature as that of the air in direct contact with its surface at the end of 1.44 hrs. In the course of heating up from 40° to 70°, the terra cotta partition would absorb

$$\text{Total heat} = (70 - 40) \times 18 \times \frac{2.49}{12} = 112 \text{ B.T.U.}$$

per sq. ft.

in which expression 18 is the assumed mean specific heat for the partition, and 2.49 the average thickness, in inches, of solid material.

If this amount of heat is absorbed in 1.44 hrs. of constant temperature, how much heat would be absorbed during the first hour? Would it be $(1 \div 1.44) \times 112$?

As it is natural to assume that the cold wall would take on heat somewhat more rapidly than the same wall would after its temperature had approximated that of the surrounding atmosphere, the rate of heat absorption would decrease. For the condition assumed, the first hour represents $1 \div 1.44$, or 69.5% of the total saturation time. On consulting the curve, we find that, if heat is absorbed for 69.5% *of the time* (0.695 on the time axis), the *amount of heat absorption* will be 95% of the total.

### DETERMINING RADIATION REQUIREMENT ON ACCOUNT OF PARTITION

The amount of heat absorbed for the first hour therefore would be $0.95 \times 112$, or 106.5 B.T.U. One half of this, or 53.2 B.T.U. per sq. ft. of partition, would be absorbed from each side of the partition. The foregoing calculation assumes constant temperature at the surface of the partition, that is 70° throughout the warming-up period. It will be noted that, for the sake of simplicity, the surfaces of the partition are assumed to be at the same temperature as the air in the room. Exact data on the variation between these temperatures will have to be derived by actual test.

Under average conditions, as already pointed out, the temperature of the partition surface would remain below that of the room for many hours. If we assume a surface temperature of 50° corresponding to a room temperature of 70°, the radiation required to heat up this partition, per square foot, for the first hour would be

$$\left[ (50 - 40) \times 18 \times \frac{2.49}{12} \right] \times \frac{0.95}{240} = 0.148 \text{ sq. ft.}$$

Inasmuch as this partition serves as the division between two spaces, one-half of this radiation, or 0.074 sq. ft. of radiation per square foot of partition, will be chargeable to each space. To get an idea of the extent to which any furniture lining this partition, in part, would further decrease this figure, computations may be made by assuming the furniture to be part of the construction, ascertaining the responsivity of the combination, and proceeding as outlined hereinafter for ceilings and floors.

### FINDING NEUTRAL POINT IN HEAT FLOW THROUGH FLOOR OR CEILING

The floor will be assumed to be constructed of 4-in. concrete, covered with a 2-in. wooden layer. In considering this slab, which is floor at one face and ceiling at the other, we are confronted with unequal materials of construction as well as unequal thicknesses of these materials. With equal constant temperatures at both faces, which will absorb more heat, the floor or the ceiling? Heat will flow from both faces toward the interior of the construction, and at some plane the heat flow will meet and neutralize. In other words, no heat will flow past this plane from either side. In a homogeneous slab, this plane will be in the middle, but where will it be in this case? Will it be nearer the ceiling surface, or nearer the floor?

To ascertain the position of this plane, imagine a line X-X, drawn, as shown in Fig. 2, at a distance y above the lower surface. In order to satisfy the condition of equal heat penetration from opposite sides of this axis, *the responsivity of the portion above this line must equal the responsivity of the portion below.*

That is:—

$$\frac{1}{(2-y)^2} \text{ must equal } \frac{(y \times 1) + (4 \times 8)}{(y+4)^3}$$

from which equation y is found to be 0.388 in.

The axis X-X may be termed the *axis of responsivity.*

To check the position of this axis, the responsivity for each portion may be derived.

$$R_f \text{ (floor side)} = \frac{1}{(1.612)^2} = 0.385 \text{ in.}$$

$$R_c \text{ (ceiling side)} = \frac{(0.388 \times 1) + (4 \times 8)}{(0.388 + 4)^3} = 0.385 \text{ in.}$$

The responsivity for the whole construction is $\frac{(2 \times 1) + (4 \times 8)}{(2+4)^3}$ or 0.157.

The responsivity of single-thick glass being 276.8, the saturation time for the whole construction will be

$$\text{saturation time} = \frac{276.8 \times 15}{0.157 \times 3600} \text{ or 7.35 hours.}$$

(Note:—For a thorough discussion of responsivity see The Heating and Ventilating Magazine for August, 1927).

The total heat absorbed by the portion on each side of the axis of responsivity for a total temperature rise of 10° is:

$$H_f = \frac{1.612}{12} \times 20.7 \times 10 = 27.8 \text{ B.T.U.}$$

where (20.7 = specific heat of wood)

$$\left(H_c = \frac{0.388}{12} \times 20.7 \times 10\right) + \left(\frac{4}{12} \times 34.5 \times 10\right)$$

$$= 121.7 \text{ B.T.U.}$$

where (34.5 = specific heat of concrete)

Knowing that a total quantity of heat equal to 27.8 B.T.U. will be absorbed through 1 sq. ft. of floor surface in 7.35 hours, we can compute the amount of heat that would be absorbed the first

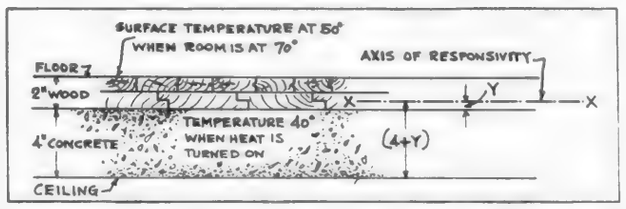



**Fig. 2. Diagram of Non-Homogeneous Floor Structure From Which Analysis of Heat Absorption Is Made**

hour for the condition of a constant room temperature (suddenly created) at both faces. The first hour of such a condition represents 1 ÷ 7.35, or 13.6% of the total saturation time. This time corresponds to 30% of the total heat absorption as shown by the curve. For the first hour of this case, therefore, the heat absorbed by 1 sq. ft. of floor surface would be 27.8 × .3 or 8.34 B.T.U.

Should it be desired to obtain the amount of heat absorbed the second hour of constant surface-temperature, it merely is necessary to consult the curve. The percentage of heat absorption for this hour will be the percentage for the two-hour period minus the percentage for the first-hour period. It must be remembered that the total heat is always the heat absorbed for a constant surface-temperature during the full saturation time. The heat absorbed by the ceiling during the first hour will similarly be 122 × 0.3 or 36.6 B.T.U. per square feet of surface.

For a room 30 ft. × 20 ft. × 12 ft. the areas of interior partition, floor and ceiling are 840, 600, and 600 sq. ft., respectively. The radiation that would have to be provided according to the previous calculations, per degree rise of surface temperature (assuming 240 B.T.U. emission), would be as follows:

| | | | |
|---|---|---|---|
| Interior Partition— | 0.0148 × 840 = | 12.43 | sq. ft. |
| Floor— | 0.01158 × 600 = | 6.95 | sq. ft. |
| Ceiling— | 0.01525 = | 9.15 | sq. ft. |
| | Total | 28.53 | sq. ft. |

When one considers that 28 sq. ft. of radiation is required to raise the mass of the construction bounding this room a single degree, it seems a factor worthy of serious thought. Whether the

engineer decides to consider a 5° or a 10° rise, he will, at least, have the satisfaction of knowing that, for a room with 100 sq. ft. of partition, he will have allowed twice as much radiation as for a room with only 50 sq. ft.

### FACTORS AFFECTING RATE OF COOLING

Heat that is absorbed by a cold building begins to leave the heated portions as soon as the heating system is shut down. The rate of cooling, following in a general way the laws applied to the rate of heat absorption, the curve shown herein may be used for computing the amount of heat given up in a certain time. After the heat supply is cut off, the outside walls and windows continue to lose heat to the external atmosphere, this rate of heat loss decreasing slowly and gradually as the temperature in the room falls. At the same time, the interior partitions, floors and ceilings, if sufficiently warmed, give up some of their heat, tending to supply some of the heat that is being dissipated by the outside walls.

Unlike the warming-up period, the room temperature falls gradually, depending upon the extent of the exposed portions, and also the degree to which the interior portions have been warmed. In considering this feature it may be well to fix practical limits for the upper and lower temperatures in the interior of the building, 70° and 30° respectively. It does not seem necessary to consider temperatures below 30°, because, at that temperature, water in all plumbing lines and fixtures would freeze.

It will be assumed that the room in this case requires 90 sq. ft. of direct radiation, or the equivalent heat on a basis of 240 B.T.U. per sq. ft. per hour for the outside walls. The outside temperature for which the heating system has been designed will be assumed at 10° F., making a temperature difference of 70° — 10° = 60°. The room temperature is 70°, and the heat is turned off. What takes place?

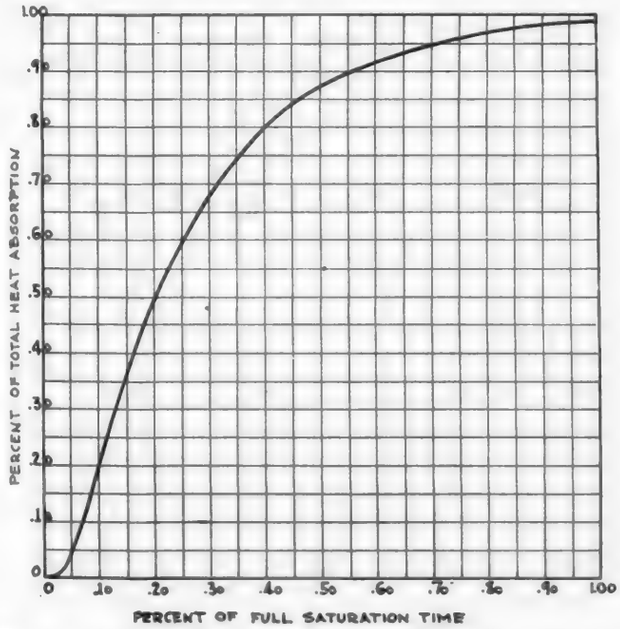



**Fig. 3. Curve Showing Percentages of Total Heat Absorbed by Walls, Ceilings and Partitions, Corresponding to Various Percentages of the Total Time Required for Complete Saturation**

The room will remain comfortable for a short while, for it will not chill immediately, due to the fact that the partitions and ceilings are still warm. However, partitions at 70° cannot give up heat and maintain an air temperature of 70° in the room. To do that they would have to provide an amount of heat equal to 90 sq. ft. of steam radiation. In previous calculations it developed that 28 sq. ft. of radiation would be required for raising the temperature of the interior 1°. We, therefore, may assume that a cooling-off of 1° would return the equivalent heat of that 28 sq. ft. of radiation. So if these interior surfaces yielded the equivalent heat at 90 sq. ft. of radiation, a cooling of 90 ÷ 28, or 3.2° would take place the first hour.

If this temperature drop is taken to be sudden (for simplicity) the resulting room temperature would be 70° — 3.2° or 66.8°. The room temperature being lower, other things being equal, the heat transmission through the outside walls will be less in the proportion of (70—10) to (66.8—10). The radiation required for this reduced temperature would accordingly be (56.8 ÷ 60) × 90, or 85 sq. ft. Repeating the above steps, 85 ÷ 28 would mean a 3° drop, resulting in a reduced temperature of 66.8° — 3° or 63.8°. This corresponds to a heat-transmission requirement of [(63.8 — 10) ÷ (70 — 10)] × 90, or 81 sq. ft. of radiation.

### ESTIMATING ROOM TEMPERATURE AFTER PERIOD OF COOLING

By continuing this step-by-step process, an interior temperature of 30° is arrived at after approximately 19 hours of cooling. Following this method, the degree to which a building may cool down in a certain predetermined time may be estimated. In case the interior surface-temperatures are below the room temperature, there would be no flow of heat into the room until the room temperature fell to that of the surfaces. For the extreme temperatures assumed (30° to 70°), the total heat that would be absorbed by the partitions, etc., of the room under discussion would be

| | (B.T.U.) | | (sq. ft.) | | |
|---|---|---|---|---|---|
| Partitions— | 149 | × | 840 | = 125,000 | B.T.U. |
| Floor— | 111 | × | 600 | = 66,600 | |
| Ceiling— | 488 | × | 600 | = 292,800 | |
| Total heat | | | | 484,400 | B.T.U. |

If we should add to this the heat stored in 50 wood seats, as in a classroom (10 board feet each), we have in addition,

$$50 \text{ seats} = \frac{10}{12} \times 20.7 \times 40 \times 50 = 39{,}000 \text{ B.T.U.}$$

(*Continued on Page* 75)

# Facing the Facts

## Aftermath of "Some Thoughts on the Combustion of Oil Fuel" Brings Out Vital Points

*By P. E. Fansler*
Associate Editor, THE HEATING AND VENTILATING MAGAZINE

IN writing a series of articles dealing with the burning of oil in domestic boilers, one thought was dominant. The time was ripe for replacing the technical "loose sales talk" relating to combustion with such facts as have been established relating to the mechanics, physics, and chemistry of the science. Continuation of an all-too-general practice of indulging in extravagant descriptions of "exclusive principles," in order to make advertising copy or catalog or brochure material, could have but one effect—to slow down the rate of expansion of the industry by increasing the sales resistance. That this has been the result of past adherence to this practice is admitted on every hand. It was time to discard fancies and join in a concerted move to tell only the simple facts.

This, then, was the idea back of the preparation of these articles—to make an easily read and understood story of oil combustion based upon known and established technology. That the articles largely succeeded in putting the message over has been evidenced by many exceedingly complimentary letters received. That they failed entirely to convince was shown by vague rumors from comparatively few sources that this story of combustion was not "acceptable." Immediately steps were taken to reach such sources and obtain specific criticisms. Two were received, and one was so pertinent as to deserve inclusion here. It reads:

### WELL-KNOWN OIL-BURNER ENGINEER DISAGREES AND THEN AGREES

"With reference to the articles you have written on the subject of oil combustion, at first I was inclined to take exception to some of the statements, but after due thought and consideration, I am inclined to accept them.

"Your statement that oil would not burn until vaporized was more or less a shock until thoroughly analyzed, and I can still realize that the old timers in the business are having a hard time to agree with you fully, still we all know that a match dipped into a pail of kerosene or fuel oil immediately will be smothered out, but at the same time, a slight vapor will arise from the oil caused by the temperature of the match during immersion. However, the same match after being ignited, laid on top of the oil, will act as a wick and cause the oil to ignite around the match, and, as the temperature is increased, the flame will spread over the entire surface.

"It is hard at first to accept your theory that atomized oil will not burn until vaporized, but after consideration of the matter of the ignition of raw oil, I fail to see how anybody can dispute the fact that the temperature of the pilot or spark vaporizes a small quantity of the atomized oil, causing ignition, which in turn continues to vaporize the rest of the atomized oil and cause complete combustion.

"This more readily is proved in the case of oil atomized by superheated steam. Due to the temperature of the steam, the oil is not only atomized, but the atomization is followed by vaporization where steam temperature has penetrated.

"It will be found in almost all jets of this type that they carry a core of unvaporized oil, which, if allowed to travel its full course, eventually will become vaporized and burn without carbonization, but if this jet is allowed to impinge on a bridge wall or other obstruction before complete combustion has taken place, carbonization or coking almost immediately will be evident.

"It is the rapidity of combustion that causes the noise. It always has been my theory that these atomized particles of oil coming under the influence of heat would suddenly explode, causing the combustion roar. But, if oxygen is excluded, this explosion cannot take place when the oil is vaporized and then when the oxygen is admitted and properly mixed with the oil-gases, a quiet flame results.

"In causing the oil to be vaporized by this method, a larger volume of combustible gases is obtained and if air is administered properly, complete combustion will be delayed and the combustion will become almost noiseless.

"Where full vaporization takes place and the air is admitted under tension and control, a quiet fire readily is obtained, but it is still a much mooted question as to whether this flame is as efficient in the case of a noisy fire where the oil is burned rapidly and with a slight excess of air. Of course, in the latter case, the temperature of the flame is much higher and its volume is much less.

### IS THERE A RELATION BETWEEN NOISE AND COMBUSTION EFFICIENCY?

"In past experiments, I sometimes have found a quiet flame to be more efficient than a hot concentrated fire, but so far I have been unable to determine if this is always the case as I have found boilers that steam slowly with a quiet fire, and would steam rapidly with the same amount of oil but with a slight excess of air and a noisy combustion. We are disregarding the efficiency of the boiler in this matter.

"At first, I was inclined to disagree with you on a number of points. The more I analyze your statements and check them up with my experience dur-

ing the last 12 years, the more I am inclined to agree with you, but I do believe that if you elaborated and explained more fully your reasons for your statements, they then would be more readily absorbed by the trade in general.

"We all have been more or less inclined to go ahead utilizing past experiences without thoroughly analyzing the data obtained, and even when these results were analyzed for our own uses, they never were put in such clear form, as they have been by you, for use by the industry in general."

### OIL COMBUSTION ARTICLES PRESENTED ONLY ACCEPTED THEORIES AND IDEAS

It is apparent, from the foregoing, and from discussion with others, that too much was attempted in these articles; too much ground was covered, with the result that each phase was handled in a somewhat sketchy way. This will be remedied, in future issues, by dealing with each step separately.

The facts that were set down in the articles referred to are not theories advanced by the writer —there is nothing original in the presentation except the choice and arrangement of the words used. It would be unfortunate if a reader assumed that "pet theories" were being expounded, as nothing could be further from the truth.

A well-founded and welcome criticism came from a combustion engineer of high standing and long experience in this field. This was an exception to a paragraph reading as follows:

"The easiest way to gain a correct comprehension of the way in which gasification is accomplished by a burner of the atomizing type is . . ." The criticism applies to the careless phrasing of the statement. It is obvious that gasification of oil is the result of heat absorbed by the atomized oil, by virtue of the *combustion* produced by the burner, and that gasification is not directly produced by the burner itself.

### WHY OIL MUST GASIFY BEFORE COMBUSTION CAN BE ACCOMPLISHED

While on this subject of gasification, it might not be amiss to straighten out one thought that appears to confuse many. Judging from some of the oil-burner literature, and from vague and unidentified expressions of personal opinions, there is not a universal acceptance of the fact that oil invariably, is converted into a gas prior to combustion. It is exceedingly simple to establish uncontrovertible testimony to support this statement.

Oil fuels commonly used for domestic heating, if heated, will gasify. The temperatures at which this phenomenon occurs, vary with the characteristics of the oils, but, for the sake of argument, may be said to approximate 200° to 250° F. Also it must be admitted that the fuels under discussion will burn. Ignition temperatures, or the temperatures that must be attained to produce combustion, vary. If a definite pure gas is to be burned, its ignition temperature can be determined with a high degree of accuracy; in burning oil the exact composition of the fuel may not be known, but the ignition point certainly will be above 325° F. A typical light, paraffin-base, crude-oil gas has an ignition temperature of 600° F.

It then must be perfectly evident that if an oil comes to the burner at the temperature of 70° F. —and then is burned—in reaching the ignition temperature, it *first* must have attained the temperature at which it is converted into a gaseous state, and above which, at atmospheric pressure, *it cannot remain a liquid.* Oil, even when so finely atomized as to appear in mist form, is still a liquid.

Is this a matter for discussion, or an axiomatic fact?

Personal opinions as to the best method of selecting salesmen, the most effective forms of advertising or the best territory in which to push oil-burner sales, are subject to dispute, but there can be no argument regarding the correctness of established technology, such as was presented in the articles in question.

## A Method of Calculating Radiation for Intermittent Heating

(*Continued from Page* 73)

In the case of a classroom we may also include wardrobes and bookcases, which would represent an amount of heat absorption approximating that of the seats. The total amount of heat absorbed would be 562,400 B.T.U. for the items thus far considered, which is *the equivalent of* 16 *boiler horse power for one room.* Even though this heat absorption, or emanation in the case of cooling, be spread over a period of 20 or more hours, it seems too profound to be ignored entirely or to be dismissed by the use of an arbitrary percentage.

A logical question would be "Is it economical to keep heat on continuously so as to eliminate the energy required for reheating the interiors?" Actual tests, if the writer's memory is correct, have proven a 10% to 15% fuel saving in favor of intermittent operation.

As it has been suggested, the heat loss through the exposed portions of the room decreases as the room temperature falls. If the temperature outdoors were 30° with no wind, and the room were cooled down to 30°, there would be no heat flow from the room whatsoever. On the other hand, the more the building is allowed to cool off, the more heat will be required for warming up in a reasonable time.

Undoubtedly, due to local and singular considerations, there is an "economical low temperature" for every structure that is heated intermittently, and this temperature once determined should be adhered to in the interest of fuel conservation. If it is found that the economical night temperature for an office building is 48°, this temperature should be maintained by automatic regulation. A higher temperature would mean fuel waste, and a lower temperature would mean uncomfortable occupants at 9.00 A.M.

# *Here Is Another Ventilation Competition*

# $150 in Prizes for the Best Designs for a Small Moving-Picture Theatre

AS promised our readers at the conclusion of the previous contest, in which the problem of ventilating a typical school building was offered for solution, THE HEATING AND VENTILATING MAGAZINE announces a new competition. The problem this time is the design of a ventilating scheme for a small moving-picture theatre, using the assumed floor plan here presented of an ordinary "movie" house, and competitors are at liberty to do any thing they may desire with the plan; that is, assume that the floor has a space under it, if desired; that the roof may be cut at any point for ventilators, if the scheme submitted makes this desirable; that there is a cellar below; that additional space back of the building is available, if necessary.

There are upwards of 20,500 small motion-picture houses in the United States, according to the 1926 statistics in the office of Will H. Hays. These are found in large cities as well as in country towns. In cities the huge motion-picture "palace" is provided with elaborate air-conditioning equipment, and, largely due to this feature, the summer crowds flock to them, and away from the small poorly ventilated "show." A simple but effective method of ventilating the small auditorium should find a ready market.

### PRIZES OFFERED

The first prize of $100 will be awarded to the contestant who submits the best ventilating scheme regardless of cost—either first or operating—and the second prize of $50 will go to the reader who designs the most practical scheme involving the best and most satisfactory layout for the least expenditure to install and operate, as well as for convenience in manipulation and requiring the minimum amount of attention. Perhaps this is a harder proposition than the one for which the first prize will be given. It has the advantage however of giving the hard-boiled practical man a chance over the "high-brow."

### SOME SUGGESTIONS FOR COMPETITORS

In view of the experience gained in the first competition, it might be well to point out at this time that some of the competitors made themselves a great deal of unnecessary work by producing finished tracings, many of which were almost working drawings. This is quite superfluous as the contest is not a drafting competition and, in any case, the drawings have to be redrawn for reproduction. What is wanted is the *idea*, sufficiently sketched out to make the operation clear to anyone familiar with this class of work.

All sketches are to be made to ⅛ in. scale, with any necessary details to ¼ in. scale. The sketches may be on tracing paper or on detail paper or on cloth—but cloth is not essential. They may be made in pencil, if the work is clear, but inked-in sketches are preferred. Designs not conforming to the above cannot be considered in fairness to the others who have followed the rules of the contest.

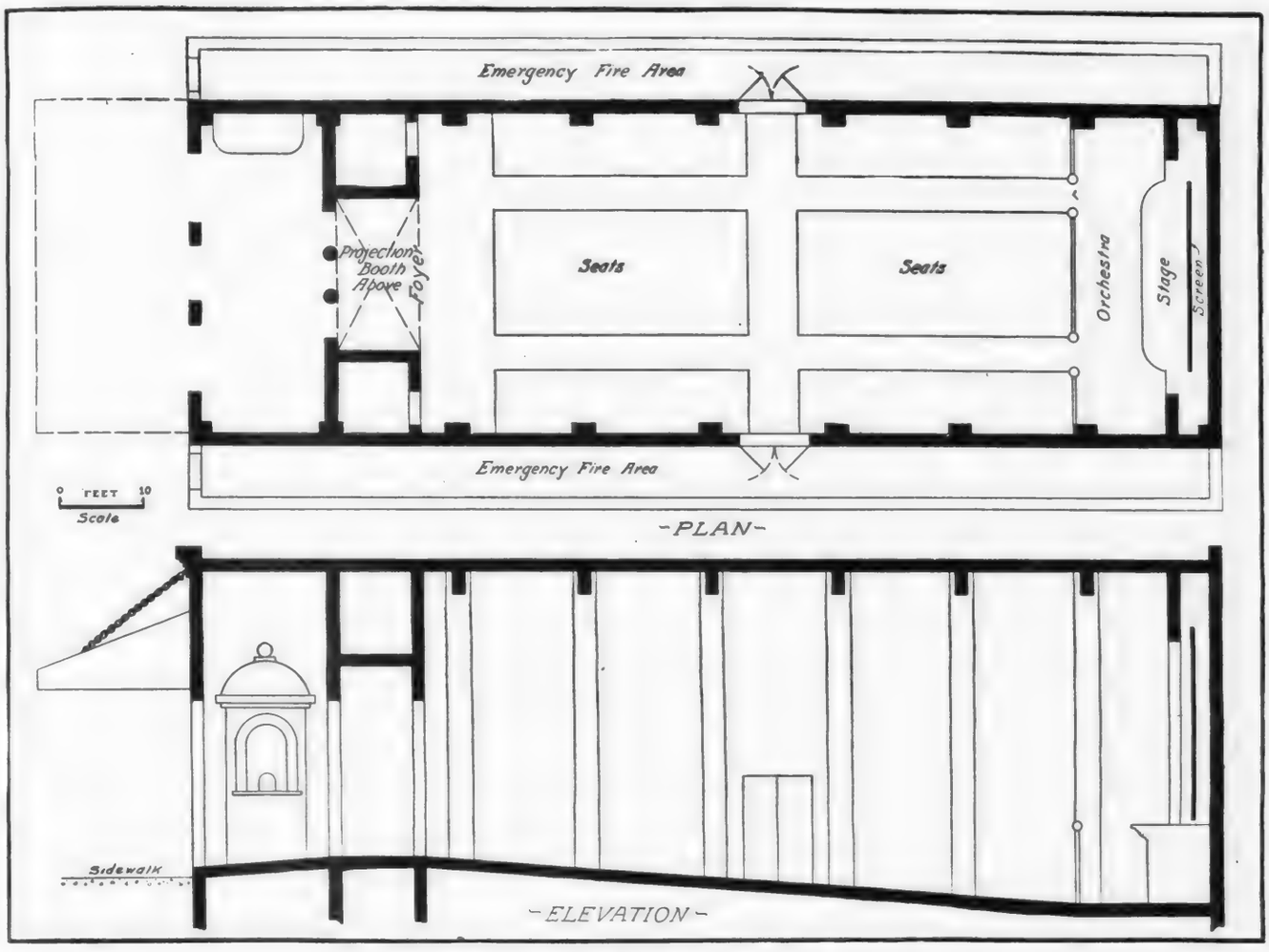
In regard to the designs submitted the following questions must be answered as briefly as possible:

### *Questionnaire*

1. What is the hourly fuel consumption (estimated) for 35° F. outside temperature, and what is the cost per hour for fuel, based on present rates in your vicinity? Quote rate used.
2. What is the power consumption for same outside temperature and full audience, based on 400 persons?
3. How much fresh air are you supplying per occupant?
4. How much exhaust air are you removing per occupant?
5. How much air are you recirculating per occupant?
6. What is the temperature of the air entering the theater?
7. What is the velocity of the air entering through the registers?
8. Have you included any means of cooling? If so, what?
9. Have you included any means of humidifying? If so, what?
10. Are you using mechanical or natural ventilation?
11. What provision have you made to safeguard the audience from fire hazard?

What have you done to prevent panics from smoke accidently getting into the theater?

12. What is your B.T.U. loss from the building as you estimate it, and how much does this exceed or fall short of the B.T.U. supplied by a full audience?
13. Have you provided any means to prevent overheating in crowded periods?
14. What means have you provided for the delivery of fuel?
15. Have you used an air washer? If so, what length?
16. Have you used any means to purify the air or clean it? If so, what?
17. Would you use the same system if the theater were located in a very cold locality and if it were located in a very mild climate?




**Plan and Elevation of Small Motion-Picture Theatre**

18. How would you prevent roof condensation if the architect does not want to put in a hung ceiling?

19. Would you use radiators anywhere and, if so, how would you run the supply and return piping?

20. Give a brief outline, in not over 200 words, of your idea and tell why you selected this particular scheme. No sales talk permitted.

### *Time of Closing Contest*

All manuscript and drawings must be received in the office of THE HEATING AND VENTILATING MAGAZINE not later than October 10, 1927, and the manuscript and drawings must be sent in the SAME package addressed to

Contest Editor,
The Heating and Ventilating Magazine,
1123 Broadway,
New York, N. Y.

Decision as to the winners of the prizes will be made by three judges, and any ideas submitted which may not win a prize, but which are considered interesting enough to deserve publication, will be so treated and paid for at regular space rates.

Don't forget the closing date, October 10, 1927.

## 1928 International Fuel Congress in London to Treat of Heating

A fuel conference will assemble at the Imperial Institute, London, September 24 to October 6, 1928, under the direction of the British National Committee, and sanctioned by the International Executive Council of the World Power Conference. Lord Balfour, former prime minister of Great Britain, has been chosen honorary president, and Sir Alfred Mond, director of the imperial chemical industries, president. Outstanding industries participating in the convention will be the coal, oil, gas, chemical and heating interests, represented by nominees to the fuel conference and technical committees.

Papers to be presented will deal with composition and classification, preparation, storage, handling and transmission, and utilization of solid, liquid, and gaseous fuels. Other subjects to be discussed are utilization of electricity for domestic and industrial heating, waste-heat recovery, and some more general aspects, such as the training of technologists, the scope of organizations concerned with efficient use of fuel in industry, and economic phases of better co-ordination in fuel utilization. It is hoped that leaders in the American industry will participate in the proceedings.

# PIPECRAFT

## VIII—Connections for Boilers in Batteries

STRANGELY enough, connecting boilers in batteries does not necessitate the greatest care on the output end; the return connections frequently introduce more troubles than the steam connections and usually are intimately associated with keeping a proper water-line in the boiler. In gravity steam systems, where the pipes are small and the pressure drop is great, or where air venting has not been carried out properly, there is always danger of the water either leaving the boiler or of the condensation not coming back, which will amount in time to the same thing.

Many practical steam fitters have entirely erroneous ideas of what a check valve will do in such cases; they either do not want to use a check valve under any consideration or go to the other extreme of thinking a check will return water to a boiler against a higher pressure. Both these ideas are wrong. A check valve has its uses, as well as abuses; it certainly will prevent a rapid backing out of the water in the boiler into the return, due to short periods of unbalanced pressure, but it will not return condensation into a boiler against a continued higher pressure. In fact, checks really are a detriment in such a case as they interpose an added resistance to the flow of the return, due to the weight of the flapper.

When boilers are connected up in battery there is often a tendency for one boiler to draw the water over from the other under certain conditions; one of these conditions is when one boiler is heavily stoked. In one instance, three boilers were set in a battery and connected to a common steam-header and a common return-header. There was no existing reason because of the piping why one boiler should be favored over another, as far as receiving the returns back into each boiler; yet, when one boiler was stoked, the water-line in that boiler promptly disappeared in the gauge glass and those in the other two dropped out of sight in the bottom of their glasses.

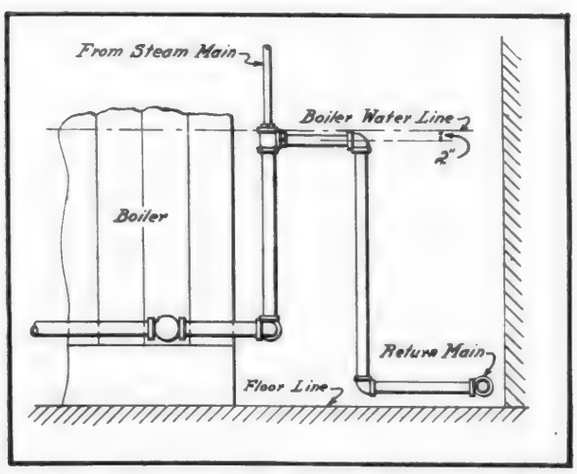



**Fig. 63. Example of the Underwriters' Loop in the Return Piping**

This peculiarity was shown in each of the three boilers without favoritism or preference, depending entirely on which boiler was stoked. A check placed in the return connection to each boiler entirely remedied the trouble. In other words, the check held the water in the stoked boiler until the fire burned through and the pressures again equalized.

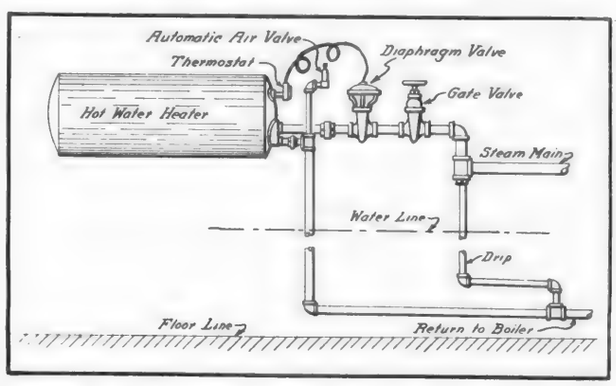



**Fig. 64. Gravity Steam Connections for a Hot Water Heater of Storage Type**

But a check would be absolutely useless in a case where the water left a boiler, due to the drop of pressure in the system, which caused the water-line in the return to rise until a long horizontal return main was flooded, because this pressure difference is a *continued* difference and not a *short-lived* one.

Many of the difficulties experienced with the connecting up of returns to batteries of boilers may be eliminated by the use of what is known as the "Underwriters' Loop," developed for this particular purpose. In brief, the Underwriters' Loop is an inverted "U" which is inserted in the return line immediately previous to its connection to the boiler. From the top of this "U" a balancing or equalizing pipe is carried to and connected with the steam line from the boiler, in much the same manner as the old method of establishing a false water-line; only, in this case, the level of the top of the "U" is below the level of the water in the boiler so that the false water-line, that otherwise would be created, is submerged under the boiler water-line.

Such a connection is illustrated in Fig. 63 and it will be understood from the drawing that any undue increase of pressure in the boiler will only

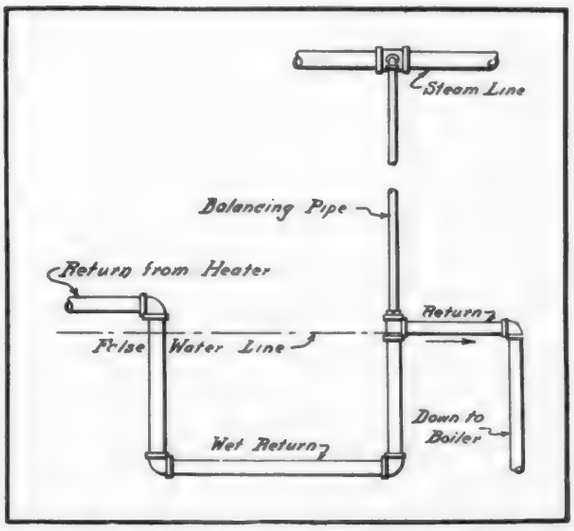



**Fig. 65. Method of Creating an Artificial Water Line in the Return**

drive the water out as far down as the level of the top of the "U", which is set only about 2 in. below the normal water-line. When the water-line reaches this point, the little balancing steam pipe comes into play and equalizes the pressure on both the top and the bottom of the water column, in the leg of the "U" towards the boiler, thus preventing any further backing out of the boiler water through this leg.

## Connections to Return Tappings

On most boilers, especially of the cast-iron, sectional type, return tappings are provided in abundance and of ample size. It becomes a question in such cases of knowing what tappings may be plugged, rather than of knowing the ones which may be connected. This is because *all* return tappings *may* be connected up to the return line without difficulty; as a matter of fact, however, this seldom, if ever, is done, owing to the fact that such procedure is both unnecessary and uneconomical.

Theoretically and practically, the preference in connecting up boiler return tappings goes to the rear inlets. The return water being always colder than the boiler water, the tapping should be inserted in the boiler at the point of lowest temperature and farthest from the locality of heat generation, i.e., the fire. The return tappings in the rear sections most nearly satisfy this condition, but it is advisable not to insert all the return water in the same section as this might cause too much reduction in temperature in one particular portion or section of the boiler; for this reason generally the first, second, and (on large boilers) the third tappings from the rear are used and on both sides.

It is true that boilers sometimes are connected on one side only, but this is likely to cause undue temperature stresses in the boiler sections so connected and is not to be recommended.

## Return Connections on Several Boilers

When several boilers are to have their returns supplied from one common heating system, the returns to each boiler should be treated separately and all drips, balancing pipes, and equalizers (if used) must be arranged so that any one, or any group, of boilers may be shut down without interfering with the operation of the others. Dripping the steam header without carefully considering this detail often causes trouble; with a single boiler the steam main drip, of course, can be connected directly into the boiler return, but with several boilers the drip must be carried around in back of the boilers and must be connected into the main return line, back of all boiler connections and boiler valves. This prevents interference with the dripping when any boiler happens to be cut out of service.

## Connecting Hot Water Tanks

The connecting of hot water tanks usually is associated with some means of temperature control to prevent the overheating of the water in the tank during periods when little or no water is being drawn off. A water heater with steam coils inside, such as commonly is termed a multi-tube storage heater, will have steam form in the heater when the same water stays too long in contact with the steam in the coils. Even when the water is being drawn off fast enough to keep the temperature from reaching the boiling point, its temperature is likely to become sufficiently high to scald users of the hot water unless they exercise great care.

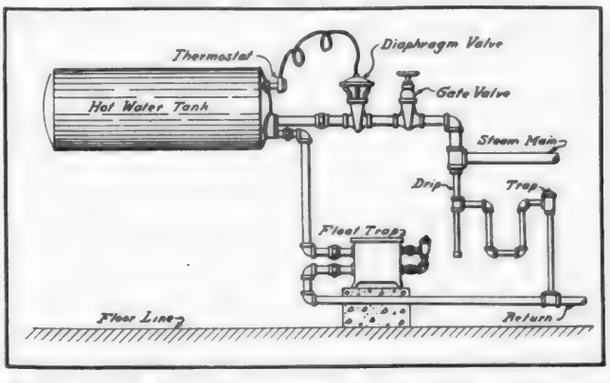



**Fig. 66. Modified Connections for Hot Water Heater When a Vacuum System Is Used**

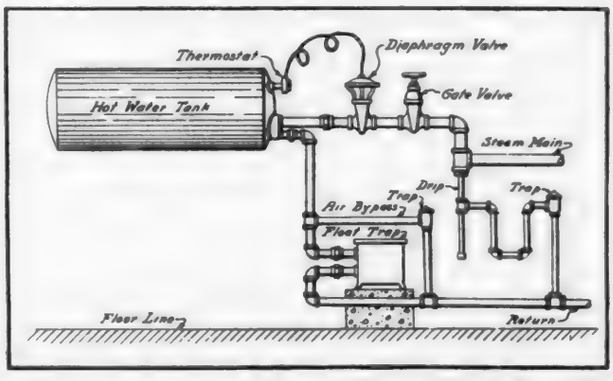



**Fig. 67. Connections in Return When a Simple Float Trap Is Used With a Thermostatic Air Bypass**

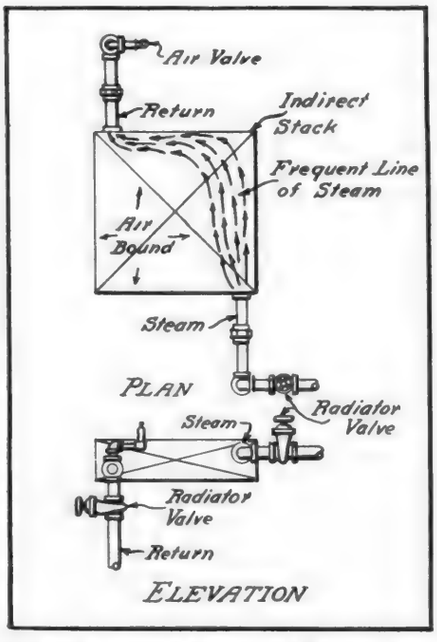



Fig. 68. Typical Steam and Return Connections on an Indirect Radiator on Opposite Sides

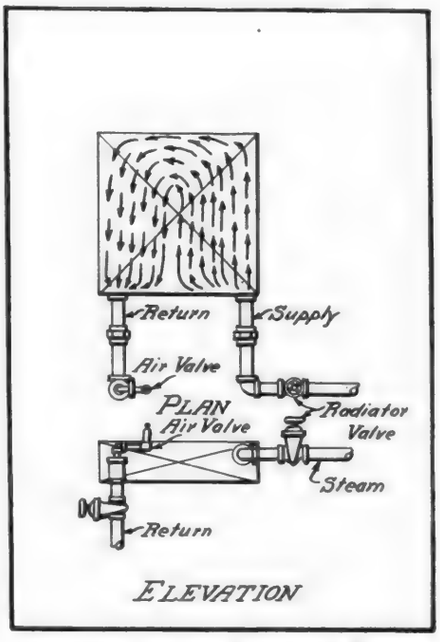



Fig. 69. Typical Steam and Return Connections on Bottom Corners of Indirect Radiator

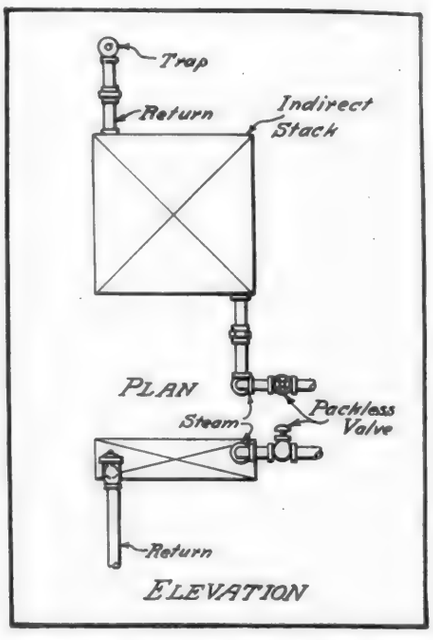



Fig. 70. Vacuum System Connections for Indirect Stacks

To prevent such contingencies a diaphragm valve and a thermostat generally are placed on all water heaters and the thermostat is set automatically to maintain a predetermined temperature of water in the heater at all times when steam is supplied and the warming capacity of the heater is not exceeded.

The sizes of steam pipe and return pipe for water heaters usually are based on the number of gallons of water to be heated per hour and the temperature rise through which the water is to be heated; this is all reduced to equivalent direct radiation and the supply and return is sized a bit more liberally than for an equivalent amount of direct radiation. This is for the reason that, if steam is turned into a tank of cold water, the condensation in the steam coil, for a short time, will greatly exceed the normal amount and the steam consumption during such a period will be greater than will occur under normal conditions.

The connections for a storage heater, with a gravity one-pipe or a gravity two-pipe system, are quite similar; that is to say, one-pipe connections generally are not used, even on a one-pipe system. As indicated in Fig. 64, the steam line is run over near the heater and dripped immediately before reaching the diaphragm valve. This not only gives dry steam to the heater coils, but also prevents water from accumulating in front of the diaphragm valve and being shot into the heater coils when the diaphragm valve opens.

Immediately beyond this drip connection is placed the stop valve controlling the steam supply to the heater when it is desired to close off the steam supply to the heater coils by hand, such as for the purpose of repairing the diaphragm valve or for any other reason. Following the stop valve is the diaphragm valve which is controlled from the thermostat and the connection from the diaphragm valve to the heater generally is made through a short length of pipe and a union.

On the return the condensation end of the heater coil is connected through a short length of pipe (also with a union) to a tee on the top of which is located a short extension of ¾-in. or 1-in. pipe about 12 in. high, with a reducing elbow at the top and an air valve set at this location. From the bottom outlet of the tee the full-sized return connection is run down below the water-line and is carried back to the boiler as a wet return, if possible. The drip from the main may be connected into this wet return as shown.

Should the level at which the heater is set be such that the boiler water-line is too far below to permit carrying back the return wet, then an artificial water-line may be created by the well-known method illustrated in Fig. 65. This involves simply raising the return at some distant point and connecting it with the steam main through a balancing pipe so as to give all the advantages of a wet return, as far as the heater condensation is concerned.

## Hot Water Tanks on Vacuum Systems

It is generally admitted that hot water tanks do not give very satisfactory service on vapor systems; on vacuum systems, however, where a constant steam pressure is held on the steam lines, no difficulties are experienced. The general scheme of connections already illustrated for gravity systems is also followed in vacuum installations, with suitable modifications; of course, it is not necessary to consider any wet return in a vacuum job and so the arrangement is changed as detailed in Fig. 66.

On the steam end the pipe arrangement is identical except that the steam pipe drip is run through

(*Continued on Page* 84)

# A Study of Steam Control in an Intermittently-Heated Office Building

## How Graphic Analysis of Steam Consumption Checks With Actual Performance

By William J. Baldwin Jr.
*Chief Engineer, Commercial Department, New York Steam Corporation.*

AN analysis of the steam demand of a typical office building recently was made as the result of data collected during thirty-two different days of the last heating season. In this period the steam, supplied from the mains of the New York Steam Corporation, was fed to the building by a device known, from the name of its patentee, as a Pendleton control.

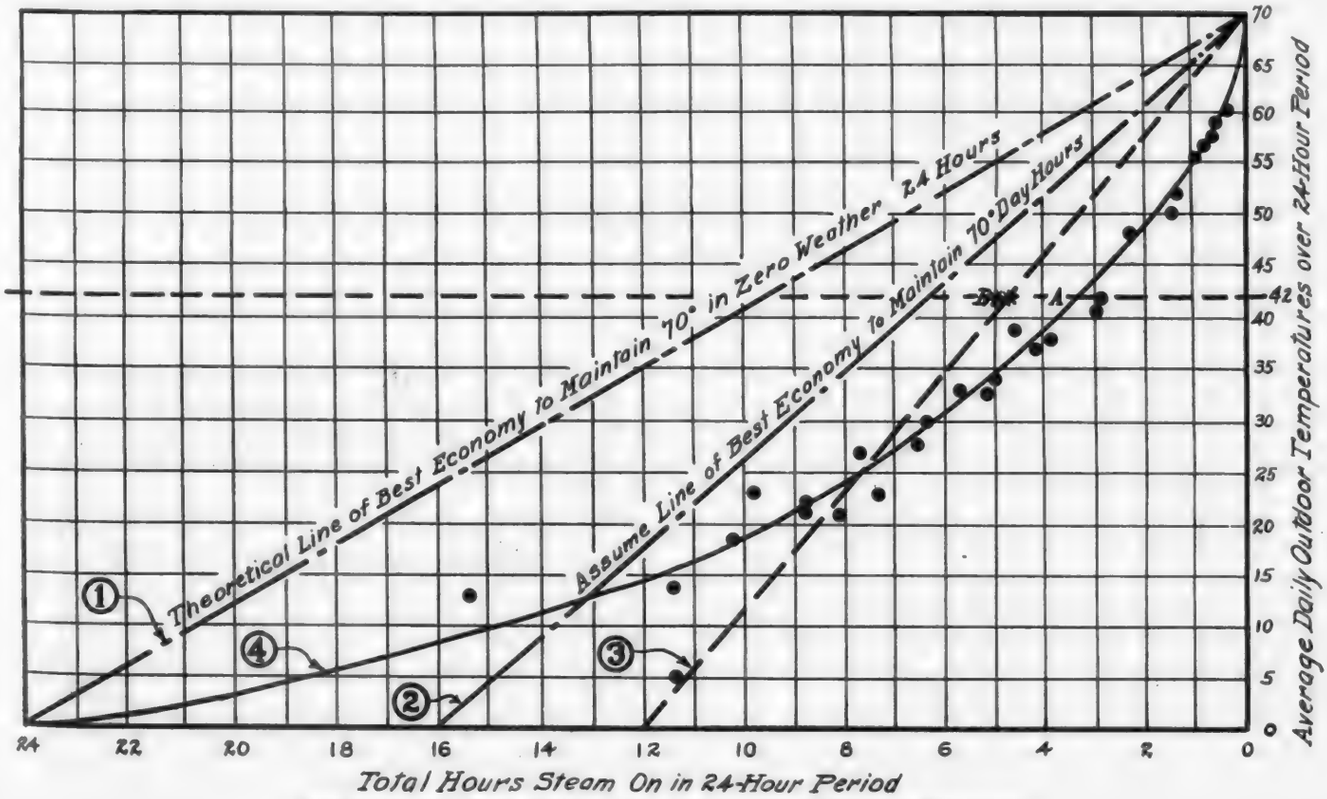
The building is a type which might be termed a day office building, with a total outside volume, above ground, of 925,000 cu. ft. (twelve stories), and a total radiation of 11,000 sq. ft. A high proportion of radiation to volume is due to the fact that it is a corner building, exposed on two sides, north and east, and exposed on the south above the fourth floor. The heating equipment was designed to heat the premises to 70° F. in zero weather, with steam on continuously. Heat was required in the premises, at 70°, from 9:00 A.M. to 6:00 P.M., which necessitated that steam be turned on at 6:00 A.M. in cold weather. Steam was not required at any time after 6:00 P.M. or before 6:00 A.M., except on three occasions, during the entire winter. Heat was maintained seven days a week throughout the winter.

It is obvious that, if the outdoor temperature is 70°, there will be no need for heat; likewise, if the outdoor temperature is 0°, steam must be "on" continuously throughout the 24 hours. So, if an abscissa is erected, representing temperatures from 0° to 70°, on a base line marked off in hours, the line 1 (see chart) represents the theoretical line of best economy for the maintenance of 70° temperature for 24 hours with any outdoor temperature.

Curve 4, on the accompanying graph, compiled from the records made, was plotted in terms of accumulated hours out of each twenty-four that the steam was "on," against the average outdoor temperature for that daily period. For example, with the average outdoor temperature 30° F., steam was "on" or used 6.3 hours out of the 24 of that particular day.

The average outdoor temperature for the season was 42° F., represented by the dotted line.

Steam consumption during the heating season


Theoretical Line of Best Economy to Maintain 70° in Zero Weather 24 Hours
Assume Line of Best Economy to Maintain 70° Day Hours
Base 42
1
2
3
4
24 22 20 18 16 14 12 10 8 6 4 2 0
70 65 60 55 50 45 42 40 35 30 25 20 15 10 5 0
Average Daily Outdoor Temperatures over 24-Hour Period
Total Hours Steam On in 24-Hour Period

**Graph Forming Basis of Analysis of Intermittent-Heating Economies**

(October 1, 1926, to June 1, 1927) was 3.586 lbs. per sq. ft. of radiation, and 4.264 lbs. per sq. ft. of building volume. As it was found necessary to maintain steam in the radiation for an average of 12 hours each day, the intersection of the dotted line indicating the average outdoor temperature, 42°, with line 3, will be the point of best operation for those conditions.

The total consumption of steam for the heating season of 243 days was 3,945,000 lbs.

### STEAM REQUIREMENTS FOR 24-HOUR HEATING SERVICE

We may assume that the radiation normally would condense an average of 0.3 lbs. of steam per hour per square foot of radiation to maintain 70° F. in zero weather, twenty-four hours per day. The line of average temperature for the season, 42° F., intersects line 1 at 9.3 hours of steam "on" for a total of 243 days of the heating season. This would mean a total of 6,779,000 lbs. of steam used for the heating season, which would be the requirement if this building were a commercial hotel, hospital or some building where a temperature approximating 70° F. was required twenty-four hours per day.

It would not be fair to assume that this building could be maintained at 70° in zero weather from 9:00 A.M. to 6:00 P.M., with boiler operation or otherwise, if steam were kept on only from 6:00 A.M. to 6:00 P.M., as indicated by line 3, as sufficient allowance then would not be made for the cooling-off of the building at night, when no steam was used (6:00 P.M. to 6:00 A.M.).

It might be fair to assume that from 9:00 A.M. to 6:00 P.M., the temperature could be maintained at approximately 70° in zero weather if steam were kept on for a total of sixteen hours out of twenty-four, as indicated by line 2. It is fair, therefore, to assume, if the building was heated with its own boiler equipment, that the steam consumption could be determined for any average temperature from this line 2, if the boiler and heating equipment were handled with care for the best economy. Taking the average temperature for the season at 42° F., line 2 intersects the 42° line at point A, showing that an average of 6.4 hours of steam "on" during a period of 24 hours is the minimum which might be expected with boiler operation, so that at 0.3 lbs. per sq. ft. of radiation per hour, the total consumption for the heating season, 243 days, would be 5,132,160 lbs. with best boiler and plant economy.

### CHECKING ACTUAL CONDENSATION RATE AGAINST ASSUMED FIGURE

Curved line 4, plotted from actual performance indicates that, with an average of 42° F. outdoor temperature, steam was actually on for 3.4 hours per day average during the heating season of 243 days. As the actual consumption, shown by the steam meter records, was 3,945,000 lbs., it would appear that the actual average condensation in the radiation per hour per square foot was 0.477 lbs. during the period that steam was actually in the radiation, when the system was intermittently supplied with the steam by the control device, rather than 0.3 lbs. per sq. ft. as commonly used.

Point B, just at the left of point A, indicates the point of highest economy with the operation of the control device. Point B was plotted on the assumption that the radiation would condense 0.3 lbs. of steam per sq. ft. of radiation per hour, and was determined from the actual steam consumption for the season, 3,945,000 lbs. A coincidence is that this point B comes very close to the line of *assumed* best possible economy with the control device line 3.

It is fair to assume that the automatic service-control device in this building has resulted in a saving equal, at least, to the time difference between the intersection of line 2 and the 42° line point B, which represents the equivalent of 1½ hours per day. For 243 days, at 0.3 lbs. of steam per hour per sq. ft. of radiation this means a total of 1,202,850 lbs. of steam for the heating season, as compared with best possible economy with isolated boiler plant operation at the building, or a saving of 23%.

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## A Floor-Coil Heating System

*By William Sommer*

THE invisible radiator has been broadly advertised lately. It certainly means a step forward in interior decoration and in heating, and is appreciated by the architect and the home owner.

Numerous schemes have been devised to heat the floor, walls or ceiling. None of these methods has been generally introduced as a broadly-recognized heating system, except the so-called "Panel" heating system of Richard Crittall & Co., Ltd., in London. A short description of this system was given in THE HEATING AND VENTILATING MAGAZINE as early as November, 1924.

If we look around in Europe for other types of invisible heating systems we find one, generally

**Fig. 1. Installing Piping for a Floor-Coil Heating System**

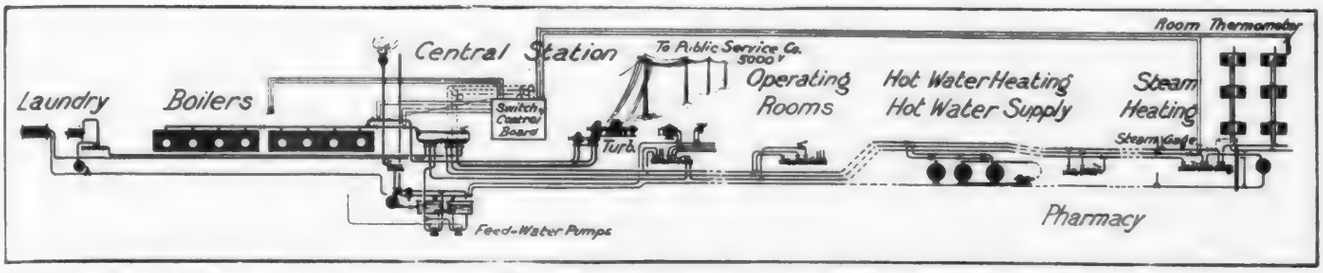


**Fig. 2. Schematic Arrangement of Heating and Power Plant for Duesseldorf Municipal Hospitals**

known but only occasionally installed, that is, the heating of floors and walls by pipes laid in air spaces underneath the surface. Old installations of this sort are to be found in hospitals, bath houses, museums, etc. Due to the general trend towards making heating surfaces less visible these systems have a timely interest for American heating men.

A description by Dr. Alter of such a system, installed in Duesseldorf, Germany, was published in *Gesundheits Ingenieur* for January 8, 1927. It is represented in Figs. 1 and 4, as applied to a hospital, especially to operating and children's rooms.

It is beyond question that this floor heating system is more expensive to install than the ordinary radiator system. But its operation cost has proven to be very economical. Judging from Dr. Brabbée's latest publications on the room efficiency of radiators, we must admit that the floor as a radiating surface has the highest efficiency. Actual tests with the system here illustrated indicate that the room temperature for comfort is 3° F. lower than with ordinary radiators.

The coils in Figs. 1 and 4 are of 2½-in. pipe, welded throughout, and put in air spaces about 8 in. high. Over this are concrete plates of 2½-in. thickness and a stone flooring.

Care has to be taken not to heat the floor too much. If complaints are heard from physicians and nurses about uncomfortably high floor temperatures, they are mostly due to the fact that low-pressure steam is used in the coils, without regulation. If floor heating is to be a success, the floor under which the coils run must be of adequate thickness, and temperature regulation provided for the coils. Also a hot water system is recommended.

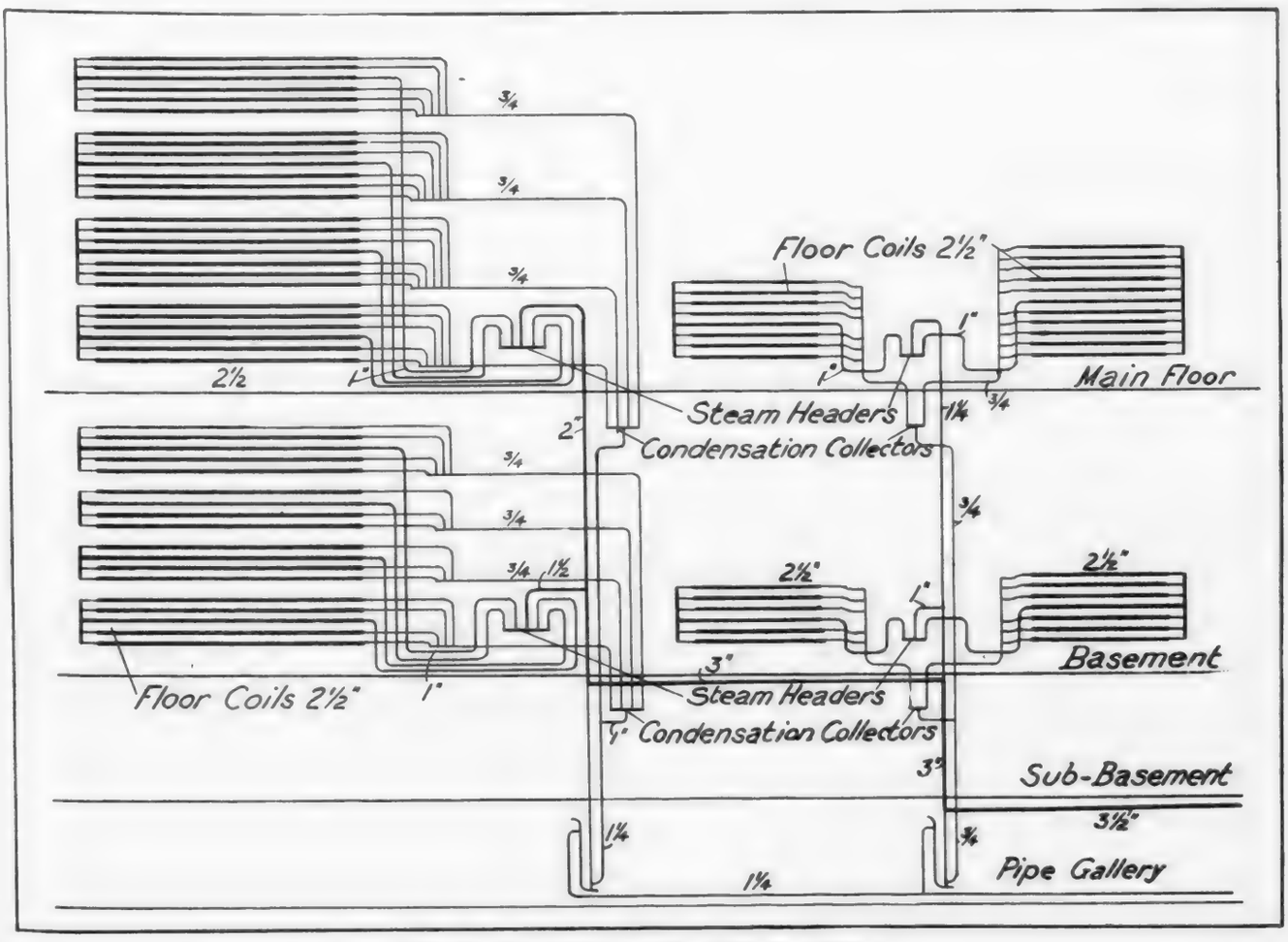


**Fig. 3. Connections of Panel Heating Units**

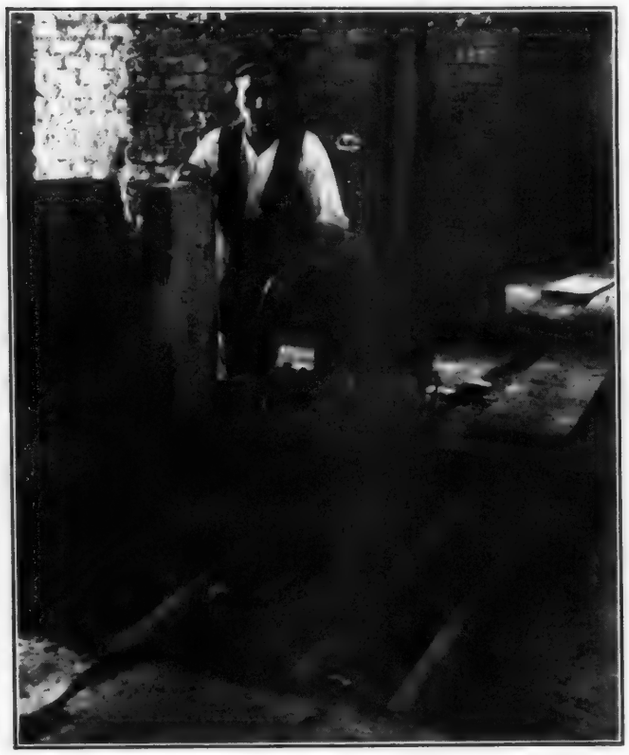

**Fig. 4. Detail of Floor-Coil System**

Floor heating with coils is part of the improvements which recently have been effected in the municipal hospitals at Duesseldorf. Steam for heating, cooking, laundry, hot-water supply and special hospital uses is taken from the exhausts of two turbines driving 250 K.V.A. generators supplying electric energy to the hospital. The exhaust pressure varies from 21 lbs. to 28 lbs. per sq. in. The general arrangement of this installation is shown in Fig. 2. In this particular instance it has been found possible to market approximately one-half of the developed electrical energy to the local public utility corporation.

Fig. 3 shows the general method of connecting the individual-panel-heating units.

**Pipecraft**

*(Continued from Page 80)*

a thermostatic drip trap before being connected to the return line. On the return end it will be seen that more alteration is made. The return may be run direct to a float or blast trap in which the thermostatic air valve is included as part of the trap, or the condensation may be run to a simple float trap and the air by-passed around the trap through a thermostatic air valve, in the manner indicated in Fig. 67.

Where indirect heaters are used for outlets located on the first-floor level, they are most often hung on the basement ceiling. Steam and return connections to this type of radiator may be made in a variety of ways, but the most satisfactory operating connections generally prove to be those involving top inlets and bottom outlets on the same side and at opposite ends. Sometimes the arrangement of the outlet at the same point as the steam —but below the steam inlet—will give an even better circulation.

AIR ELIMINATION ESSENTIAL FOR PROPER FUNCTIONING OF INDIRECT STACKS

It is by all means highly desirable to seal the returns from such heaters with a water seal, such as has already been described for water heaters when installed with the same type of steam systems; air valves give better service and keep the indirect radiator freer of air if installed on the return connection, immediately after leaving the radiator, than they do generally if attached to the radiator direct.

In actual installations the steam often shows a tendency to heat the side of the indirect stack opposite the inlet connection and this may be due to the fact that the inlet velocity is sufficient to shoot the steam across the radiator until it is stopped by impinging on the farther side. When the return connection is on the farther side the steam frequently makes a bee-line toward the return outlet and leaves the balance of the radiator air bound.

Of course, in such instances it may be necessary to attach additional air valves to the radiator itself in order to rectify, as far as possible, the faulty steam and return connections. Where connections properly are made, however, the air valve on the return pipe should answer every need. In Fig. 68 is illustrated typical steam and return piping for an indirect radiator in which the steam inlet and return outlet are made at opposite sides of the radiator, while in Fig. 69 is shown similar piping for steam inlet and return outlet made on the same side of the radiator.

## Vacuum Steam Connections for Indirect Stacks

In vacuum steam heating the same principles are followed, with suitable modifications for vacuum circulation; under the conditions existing in vacuum systems the diagonal connection, such as ordinarily is used with vacuum system direct radiators, is preferable. This consists of taking the steam in the high tapping of the indirect stack on the return out of the diagonally-opposite lower tapping of the stack, as shown in Fig. 70.

Naturally, no air valves are used as the air all goes back through the thermostatic trap and return piping. Where these stacks reach large proportions it may be desirable to substitute a float or blast trap, such as has already been described for water heaters.

*Next month: Receiver pumps for gravity systems, vacuum pump connections and piping, vacuum pump control, fixed-differential vacuum pumps, air-separating tanks, and Vento heater connections for gravity steam.*

*This is the twenty-sixth lesson of*
*The Heating and Ventilating Magazine's*

# New Home-Study Course in Gravity Steam and Water Heating

## Lesson No. 26—Ratings of Steam and Water Boilers*

*By Ara Marcus Daniels*

CAPACITIES and ratings of boilers is a dangerous field for trespass, yet, no course of study that attempted to acquaint a student with a knowledge of heating, would be even partially complete without, at least, a superficial coverage of this most interesting, most important, most elusive, and most necessary part of heating work.

Happily, the task is made somewhat easier and the possibilities of the future considerably brighter for a unified understanding and consideration of boiler ratings and capacities since the adoption in June, 1927, by the American Society of Heating and Ventilating Engineers, of the report of its committee for Rating Low-Pressure Heating Boilers.

### CAPACITIES AND RATINGS

Owing to the multiplicity of terms used in boiler catalogs for expressing the rating or capacity of boilers, it is difficult for the student, or one who has not had intimate contact with performances of different boilers, to make a comparison of two or more—and much more difficult to make a safe selection.

Nothing, in the opinion of the writer, is more necessary to the heating fraternity than a common and universally applicable formula which will standardize boiler selection. Until such time as this is possible, the student should be on his guard and properly equipped with a knowledge of the meanings of boiler capacity and boiler rating to judge each on its merits.

### BOILER HORSE POWER

Originally, boilers were built for power purposes. Hence, a boiler was rated in terms of horse power. A boiler horse power is the rate or energy required to evaporate (per hour) 34.5 lbs. of water at 212° F. into dry steam of 212° F.

If water, at a temperature of 212° F., is fed into a boiler and evaporated, that is, changed into steam having the same temperature and being under the same pressure as the water, evaporation is said to take place *from and at* 212° *F.*

#### Work Problem B-3-1

In practice, the feed water enters the boiler below 212° F. and the actual conversion into steam usually takes place at temperatures above 212° F. Thus, under operating conditions, the quantity of water actually evaporated would be somewhat different from that where temperature of water and steam were the same, namely, 212° F.

If the quality of the steam is known, that is, the per cent of moisture per pound, and the actual quantity evaporated or produced is known, then, by means of a steam table, the evaporation equivalent to what it would have been *from and at* 212° *F.* may be computed. If the quantity of coal fired during the time consumed in obtaining this equivalent evaporation were known, then the rate of equivalent evaporation per pound of coal *from and at* 212° *F.* may be found by dividing the total equivalent pounds evaporated by the total pounds of coal fired. All quantities usually are expressed on an hourly basis.

This value for pounds of water which the boiler would evaporate from and at 212° F. is known as the *equivalent evaporation from and at* 212° *F.* and is the quantity by which horse power rating of a boiler is measured. Consequently, if the total equivalent evaporation per hour be divided by 34.5, the boiler horse power developed will be obtained.

#### Work Problem B-3-2

Capacities or ratings of power boilers therefore express quite exactly the measure of what the boiler will do under certain operating conditions.

### LOW-PRESSURE HEATING BOILERS

The problem of the low-pressure heating boiler is quite a different matter. Up to the present time, there has been a vast difference in the ratings of the many low-pressure heating boilers due to the fact that no standard code has been adopted whereby the manufacturers could co-operate in such standardization.

Low-pressure boilers, either steam or water, usually are rated in terms of the number of square feet of standard cast-iron direct radiation standing in still air at 70° F. which the boiler is capable of supplying when the plant is operating under stable conditions and proper allowance has been made for the radiation load due to piping and connections.

Manufacturers' ratings of boilers are those values found in respective manufacturer's catalogs

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and express the measure of the performance of the particular boilers as placed thereon by each manufacturer. Such ratings sometimes are given for well-defined operating conditions; at other ratings, for what the manufacturer may assume to be average working conditions. Such ambiguity were best avoided.

### BASIS OF BOILER RATINGS

Perhaps the most universally applied method for rating low-pressure boilers up to the present time is as follows:

For steam boilers: To base the rating on a gage pressure of 2 lbs. per square inch at the boiler and a condensation rate of 0.25 lbs. of steam per square foot of direct cast-iron radiating surface standing in still air at 70° F.

For water boilers: To base the rating on water leaving the boiler at 180° F. and a transmission rate of 150 B.T.U. per square foot direct cast-iron radiating surface standing in still air at 70° F.

Heating and Piping Contractors National Association stipulates that the effective rating of heating boilers shall be expressed in terms of square feet of direct radiation load (equivalent to 240 B.T.U. emission per hour per square foot of steam radiation, or 150 B.T.U. per hour for water radiation), as determined by the following formula:

$$\text{For steam boilers, output} = \frac{W \times H \times E}{240}$$

$$\text{For water boilers, output} = \frac{W \times H \times E}{150}$$

Where

W = average dry fuel burned per hour in pounds for period of the test.
H = heat value per pound of dry fuel in B.T.U.
E = efficiency of boiler.

While it might seem quite simple to establish a boiler rating from the above, there are other factors which influence those already mentioned. Few catalogs for low-pressure heating boilers contain all the data necessary to determine fully the suitability of a boiler for a particular installation.

Most boilers are selected on the basis of the ratings given in the catalog. Such ratings may be stated as "guaranteed ratings," yet, without knowing the pounds of coal burned per hour per square foot of grate surface when the rating was fixed, the stack temperature during the rating test and the number of hours the boiler is supposed to operate and maintain its rating on one charge of fuel, a full appreciation of the capacity of the boiler is lacking.

Thus, grate surface, fire travel, heating-to-grate-surface ratio, combustion rate, firing period, stack temperature, draft at base of stack, size and height of chimney, combustion efficiency, condensation rate, and boiler efficiency, all contribute variable factors which have an effect upon the suitability of a particular boiler for a given service.

**Work Problem B-3-4**

In the preceding lesson, the subject of draft was considered. It should be realized that every boiler when installed works under given fixed conditions so far as the size and height of the chimney are concerned, and that this size and height of chimney determine the available draft. The available draft determines the rate at which fuel can be burned, while this combustion rate controls essentially the evaporation rate. The area of grate in square feet and the combustion rate definitely set the total fuel which can be burned during one hour, and the total fuel consumed in one hour together with the evaporation rate determine the total evaporation. The total evaporation establishes the measure by which the boiler may be said to be capable of supplying a definite amount of standing direct cast-iron radiation.

Thus, for one set of values for each of the above quantities, a definite rating might be assigned to the boiler. Change the value of any one of the factors and immediately the rating is affected.

**Work Problem B-3-5**

### DETERMINING DEMANDS

Until such time as a definite and specific method of boiler selection is universally adopted, boiler capacity will be rated on the basis of the standing direct radiation or equivalent on the job for which the boiler will be installed.

In Part R of this course, devoted to Radiators and Radiation, the student was taught how to determine the area of radiators, steam or water, required to overcome or compensate for the heat loss from the room in question. In using radiation area as basis of boiler capacity, it must be remembered that before the heating medium reaches a radiator it must pass through pipes from which heat is radiated.

So, if a definite quantity of heat is required in the radiator, then sufficient additional heat must leave the boiler to provide for the loss from mains, branches, risers and all piping. Therefore, in order to assure ample boiler capacity, (1) the boiler capacity figured on radiator area above must be increased by some amount that will include safe allowance for piping, etc., or (2) the radiators should be reduced by an amount equivalent to the radiation supplied by mains, risers, returns, etc.

For rough approximation, an allowance of 25% to 50% in excess of the boiler capacity required for radiator radiation commonly is made to care for secondary losses. The heat loss from the boiler and from the distributing mains, even when these are well-covered, may equal 25% of standing radiation; while, with boiler and pipes uncovered, it will amount to 50% or more, depending on the exposure of the boiler room and the exposure of spaces through which pipes are run.

Under (2) above, it was stated that radiators may be reduced by an amount equivalent to the area of piping serving them. In general, this is not considered good practice unless the amount of piping passing through the room in which the radiator is located is relatively large in proportion to the area of the radiator. When this is the case, considerable saving in cost of radiators may be effected by a careful consideration of this feature of the installation.

The surface of all mains and risers always should be considered with reference to the amount of steam they condense or their cooling effect upon the water.

In Table R-2-2 presented in THE HEATING AND VENTILATING MAGAZINE, for January, 1926, the lineal feet equivalent to 1 sq. ft. of external surface for different size pipe are given with which equivalent radiating surface easily may be computed by scaling the piping layout.

### RADIATION OTHER THAN DIRECT

If radiation, other than the direct form is used, boiler capacity must be increased in proportion as those surfaces may condense steam or cool water more or less rapidly than direct radiation. Such may be illustrated by considering the demands on a large steam boiler where excessive piping area makes the condition particularly impressive. The proportion of piping area to total radiating surface, however, may be little greater than found in many average installations.

Assume the total radiation area for a given installation to be 6000 sq. ft., representing that of all radiators and piping without respect to the kind of radiation.

Assume this total condensing or cooling area to be of three kinds, and distributed as follows:

| | Sq. ft. |
|---|---|
| (A) Direct radiation standing in still air at 70° F. | = 3300 |
| (B) Indirect radiation | = 1600 |
| (C) Mains, branches, risers, and other piping standing in still air at 60° F. | = 1100 |
| Total radiating surface | = 6000 |

Assume the rating of the boiler under consideration to have been made on the basis of 2 lbs. per square inch gage at the boiler and that every square foot of radiating surface standing in still air at 70° F. will condense ¼ lb. of steam per hour.

If the total surface of 6000 sq. ft. were all direct radiation standing in still air at 70° F., the boiler could be selected directly from a table of ratings prepared on the above stated basis. Such, however, is not proper since proper corrections and allowances must be made to care for differences in the condensing power of the various surfaces. Procedure is as follows:

First: Determine total steam required per hour for the direct radiating surface by dividing square feet of surface by 4 (1 lb. steam per 4 sq. ft.).

$$3300 \div 4 = 825 \text{ lbs. per hr.}$$

Second: Determine total condensation from the indirect radiation by dividing square feet of surface by its condensing rate. This rate depends upon the temperature and velocity of the air entering and passing through the indirect stack, its area, etc. For this example, assume 1 lb. per hr. for every 2.5 sq. ft. of indirect surface.

$$1600 \div 2.5 = 640 \text{ lbs. per hr.}$$

Third: Determine total condensation from the piping by dividing square feet of piping surface by its condensing rate. This rate will depend upon the temperature of the surrounding air and as to whether or not the pipe is covered; when covered, the material and thickness affect the rate of condensation. For this example, assume a rate of 1 lb. per hr. for every 3.33 sq. ft. of piping.

$$1100 \div 3.33 = 330 \text{ lbs. per hr.}$$

Fourth: Add results, First, Second, Third, and get the total required quantity of steam in lbs. per hr.

$$825 + 640 + 330 = 1795 \text{ lbs. per hr.}$$

Fifth: Express result Fourth in square feet of direct radiating surface by multiplying it by 4.

$$1795 \text{ lbs.} \times 4 = 7180 \text{ sq. ft. direct radiation.}$$

Sixth: Select a boiler rated to have ample capacity.

If the boiler selection had been made on the original figure of 6000 sq. ft. of radiating surface exposed to air at different degrees of temperature and air velocities, it would have been an improper selection. The above example shows that the increased steam condensing effects of the different radiating surfaces demands a boiler rated (as above) at not less than 7200 sq. ft.

Thus, by due consideration of the effect of *all* radiating surface, steam requirements are more definitely established and boiler selection is made on a more stable basis.

**Work Problem B-3-6**

### TOTAL BOILER DEMANDS

It was explained in the foregoing that when selecting a boiler care should be taken to include *all* demands on the boiler. It also was stated that the condensing ability of the piping was governed by its covering or no covering. While it is not the purpose at this time to take up results of tests of different pipe coverings, the student should realize that the type of covering has much to do with heat loss from pipes.

Table B-3-1 will assist in approximating boiler capacity required when the effect of covered or uncovered piping is considered. The upper figures in the body of the table should be used where pipes are to be uncovered; the lower for covered pipes.

Thus, if a job contained 725 sq. ft. of standing radiation and the area of piping totaled 145 sq. ft., the boiler rating nearest above requirements will be:

975 sq. ft. where pipes are uncovered.
825 sq. ft. where pipes are covered.

# TABLE B-3-1

## TOTAL DEMAND ON BOILERS

### RADIATION - DIRECT AND EFFECT OF PIPING

TOTAL TAX - PIPES UNCOVERED, UPPER FIGURES
TOTAL TAX - PIPES COVERED, LOWER FIGURES
DIRECT RADIATION STANDING IN AIR AT 70° F - MAINS IN CELLAR AT USUAL TEMPERATURES.

| SQUARE FEET OF RADIATION | SQUARE FEET OF PIPING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 100 | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 |
| 200 | 350<br>250 | | | | | | | | |
| 250 | 400<br>300 | | | | | | | | |
| 300 | 450<br>350 | 525<br>375 | | | | | | | |
| 350 | 500<br>400 | 575<br>425 | | | | | | | |
| 400 | 550<br>450 | 625<br>475 | 700<br>500 | | | | | | |
| 450 | 600<br>500 | 675<br>525 | 750<br>550 | | | | | | |
| 500 | 650<br>550 | 725<br>575 | 800<br>600 | 875<br>625 | | | | | |
| 550 | | 775<br>625 | 850<br>650 | 925<br>675 | | | | | |
| 600 | | 825<br>675 | 900<br>700 | 975<br>725 | 1050<br>750 | | | | |
| 650 | | 875<br>725 | 950<br>750 | 1025<br>775 | 1100<br>800 | | | | |
| 700 | | 925<br>775 | 1000<br>800 | 1075<br>825 | 1150<br>850 | 1225<br>875 | | | |
| 750 | | 975<br>825 | 1050<br>850 | 1125<br>875 | 1200<br>900 | 1275<br>925 | | | |
| 800 | | | 1100<br>900 | 1175<br>925 | 1250<br>950 | 1325<br>975 | 1400<br>1000 | | |
| 850 | | | 1150<br>950 | 1225<br>975 | 1300<br>1000 | 1375<br>1025 | 1450<br>1050 | | |
| 900 | | | 1200<br>1000 | 1275<br>1025 | 1350<br>1050 | 1425<br>1075 | 1500<br>1100 | 1575<br>1125 | |
| 950 | | | 1250<br>1050 | 1325<br>1075 | 1400<br>1100 | 1475<br>1125 | 1550<br>1150 | 1625<br>1175 | |
| 1000 | | | 1300<br>1100 | 1375<br>1125 | 1450<br>1150 | 1525<br>1175 | 1600<br>1200 | 1675<br>1225 | 1750<br>1250 |
| 1100 | | | | 1475<br>1225 | 1550<br>1250 | 1625<br>1275 | 1700<br>1300 | 1775<br>1325 | 1850<br>1350 |
| 1200 | | | | 1575<br>1325 | 1650<br>1350 | 1725<br>1375 | 1800<br>1400 | 1875<br>1425 | 1950<br>1450 |
| 1300 | | | | 1675<br>1425 | 1750<br>1450 | 1825<br>1475 | 1900<br>1500 | 1975<br>1525 | 2050<br>1550 |
| 1400 | | | | | 1850<br>1550 | 1925<br>1575 | 2000<br>1600 | 2075<br>1625 | 2150<br>1650 |
| 1500 | | | | | 1950<br>1650 | 2025<br>1675 | 2100<br>1700 | 2175<br>1725 | 2250<br>1750 |
| 1600 | | | | | | 2125<br>1775 | 2200<br>1800 | 2275<br>1825 | 2350<br>1850 |
| 1700 | | | | | | 2225<br>1875 | 2300<br>1900 | 2375<br>1925 | 2450<br>1950 |
| 1800 | | | | | | 2325<br>1975 | 2400<br>2000 | 2475<br>2025 | 2550<br>2050 |
| 1900 | | | | | | | 2500<br>2100 | 2575<br>2125 | 2650<br>2150 |
| 2000 | | | | | | | 2600<br>2200 | 2675<br>2225 | 2750<br>2250 |

**Work Problem B-3-7**

Heating boilers, especially for residence work or where attendance of the fire is not continuous, are rated to carry the square feet of direct radiating load for a definite period of time. A proper appreciation of the rating cannot be had unless there is stated the length of time that a boiler will carry its load on one supply of fuel.

An 8-hour firing period and an average condensing rate of 0.25 lbs. of steam per hour per square foot for radiators and piping is a common basis for tables of boiler ratings in terms of standard column direct steam radiation.

For water radiation, the steam rating may be multiplied by 1.6. In lessons R-1 and R-2, published in THE HEATING AND VENTILATING MAGAZINE, for January and February, 1926, the development of heat emissivity factors for different radiating surfaces and different heating media were explained. For average steam radiators, an emissivity of 240 B.T.U. per hr. per sq. ft. is commonly used; for water radiation, the factor is 150 B.T.U. per hour. So the ratio of 240 ÷ 150 or 1.6 represents the amount of net equivalent standard direct water radiation for a given amount of steam radiation.

If a given boiler has a rating of 500 sq. ft. for steam and 800 sq. ft. for water radiation, and the rating is made on the basis of an 8-hour firing period, a change in the ratings must be made should a different firing period be considered.

An understanding of the development of the 8-hour rating is essential. Tests must be run. All fuel used and steam produced must be carefully measured. With these data, the way is clear.

Assume a boiler fired with 161 lbs. of hard coal, 125 lbs. to be consumed during 8 hours with 36 lbs. as the reserve for rekindling and igniting the new charge. If during the 8-hour operating period it was found that 1000 lbs. of water had been changed into steam, then for every pound of coal burned during the 8 hours there was produced 1000 (lbs. water) ÷ 125 (lbs. coal) = 8 lbs. of steam.

This quantity, pounds of steam per pound of coal, is known as the evaporative power of the boiler.

Since 1 sq. ft. of radiation is considered to condense ¼ lb. of steam per hour, the rating of the boiler on an 8-hour firing period may be found by dividing the total steam produced in that time by the product of the evaporative rate × ¼. Thus, for the example considered:

1000 (lbs.) ÷ (8×¼) = 500 sq. ft. (steam)
or 500 × 1.6 = 800 sq. ft. (water)

**Work Problem B-3-8**

If the firing period is 6 hours, the rating of the boiler may be referred to this basis by dividing the total steam produced during 8 hours by the product of 6 (hours) × ¼ (condensing rate). For the above case, the boiler on a 6-hour rating basis would be:

1000 (lbs.) ÷ (6×¼) = 667 sq. ft. (steam)
or 667 × 1.6 = 1067 sq. ft. (water)

**Work Problem B-3-9**

EFFECT OF INCREASED CONDENSATION RATE

The effect of condensation rate on capacity of the boiler was touched upon in connection with surface of piping, etc. It may be employed directly with the evaporating rate obtained from boiler test data.

The condensation rate of 0.25 lb. per hr. per sq. ft. of radiation will be greater in the case of an extended pin-type indirect radiator. For such a radiator having a capacity of 275 cu. ft. of air per hr. per sq. ft. of radiation, the condensing power of this radiator may be taken at 0.645 lbs. Therefore, if a boiler is to generate steam for such indirect radiators and its total evaporating power in an 8-hour test was 1800 lbs., its rating when supplying these radiators would be 1800 (lbs.) ÷ (8×0.645) = 349 sq. ft.

**Work Problem B-3-10**

CONDENSATION FACTOR

The coefficient of heat transmission for different types of radiators was given in Table R-2-1 in Lesson No. 14, presented in THE HEATING AND VENTILATING MAGAZINE, for January, 1926.

If the factor 1.65 is selected, as the number of B.T.U. given off per square foot of area in one hour per degree difference in temperature between that of the radiator and that of the surrounding air, and this factor be multiplied by 150, the standard temperature range (the student is referred to Lesson 14 for a full discussion of the effect of temperature range on the transmission factor), the transmission rate for a steam radiator of 247.5 B.T.U. is obtained. (For rapid computations, the even number 248 is commonly used.)

Latent heat of vaporization was explained in Lesson 1 of the course presented in THE HEATING AND VENTILATING MAGAZINE, for November, 1924, and in Lesson No. 16 in the March, 1926, issue. By Table S-1-1, April, 1926, issue, the latent heat of evaporation is 970.4 B.T.U.

While the steam which condenses in a radiator is under a slight pressure with a consequent lower value for latent heat of vaporization, this value 970.4, so far as practical results are concerned, represents the number of heat units given up by each pound of steam condensed. Therefore, if 970.4 be divided by 248, the result, 3.91 shows the number of sq. ft. of radiation having a coefficient of heat transmissions of 1.65 that are required to condense 1 lb. of steam. Calling this 4 sq. ft., the condensation rate of 0.25 lb. per sq. ft. per hr. is obtained.

**Work Problem B-3-11**

If conditions are other than standard, then the radiator transmission factor must be determined as explained in Lesson R-2, and this value used to obtain the condensation rate factor.

*(To be Continued)*

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IN presenting, last month, the proposed A.S.H. & V.E. code for rating low-pressure heating boilers, we captioned the draft with the query, "What is the Matter with This Code?" Although indicating an aversion on the part of the manufacturers to commit themselves, the character of the answers plainly shows the state of affairs from their point of view. Aside from the difficulty of devising a code that can be applied with equal justice to all types of boilers, a point is made which seems to us of the first importance, especially when it is considered that any change in the rating of boilers is likely to prove immensely costly to the manufacturers who have many millions of dollars invested in plant, stock, good-will and other assets. We refer to the fact that the A.S.H. & V.E. and the H. & P.C.N.A. are working independently on the project and through their own organizations. Yet here is a problem which affects vitally all branches of the industry—manufacturers, as well as engineers and contractors. If the practice of the American Engineering Standards Committee were followed, these various interests would all be represented officially on a "sponsor" committee and the resulting code would represent the minds of those interests.

As matters now stand, it is evident that considerable misgiving exists on the part of the manufacturers as to whether *any* code devised by engineers or contractors, or both, can be equitable to the boiler interests. In fact, from the manufacturers' standpoint, the whole matter revolves about the word "equitable." Word comes to us from one source, for instance, that the flue-gas temperature set in the A.S.H. & V. E. code is too high—that it should be 400° F., rather than 700° F. In support of this contention, test data are offered, indicating 400° F. as the most economical condition for the boiler in question. It is further objected that, with such a high flue temperature, the firing periods cannot be over a half-hour apart, which means constant attention; also that the high flue-temperature permits the marketing of a short-pass boiler, with its low efficiency. From another source we are advised that the committee has taken too low a figure —that it should be 1000° F. It is a striking fact, in this connection, that the figure set by the committee is an exact average of these extremes.

Another correspondent points out that one type of boiler requires a very high chimney and another type, a low chimney, and that these conditions cannot be reversed without seriously affecting both the rating and the efficiency on which the boilers were given their catalog listing. Still another correspondent makes the very good point that the daily winter heat-output of a low-pressure heating boiler is an ever-changing quantity and that this fluctuating performance is obtained by retarding or accelerating automatically the combustion of the fuel, and he presents some convincing figures on the effect of this characteristic on the charging period, heat output, efficiency, stack temperature and chimney dimensions. These and similar considerations show how easily a code such as that proposed may mean the ascendancy of some types of boilers and the possible elimination of others. The stake is too large to place the decision in the hands of any one section of the industry.

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ON the other hand, here is a trade or profession, call it what you please, composed of those who buy and install heating equipment and who make the very moderate demand for a guarantee of this equipment, just as the stamp of guaranteed purity adorns the can of soup and the trade-mark stamps the individual nut. The contractor, it must be remembered, is required to guarantee the performance of the boilers he installs and naturally is the main force demanding the establishment of an equitable rating of heating boilers. Lacking the essential data from the manufacturers, it has devolved upon him either to accept the situation as it was or to devise a code of his own. So, the fact remains that the heating engineers and contractors are the most interested parties and of right should be given the data they need for correctly designing and installing their boiler plants. The problem, as we see it, is so to define an "equitable" method of rating boilers that the minimum of disturbance to the manufacturers will result.

# Formulating the Boiler Code

## Report of A.S.H.& V.E. Committee Tells What Factors Were Considered Paramount, and Why

THIS report* has been prepared to accompany the proposed A.S.H. & V.E. Code for the Rating of Low-Pressure Steam Heating Boilers. (The code itself appeared in last month's issue). The committee considers it advisable to discuss the proposed code very fully, to explain and justify its conclusions, and to show how the code will operate in its application, as far as that can be done without having the accumulated data of experience which will result from applying the code to a variety of types and makes of boilers.

The committee has given full consideration to possible alternative methods and to objections which may be raised. This report covers these in brief in the expectation that it will form a basis for discussion, since it is essential that reasons for disagreement must be treated in a logical order if a solution is to be obtained.

The committee rejected any method of rating definition based on the dimensions of the heating surface or firepot as being inadequate for the requirements of the trade, and recognized that it must be expressed as heat output as obtained by test. Consequently a rating must be based on a combination of a definite boiler with a definite fuel consuming device, and ratings based on the boiler construction alone, as in the present practice for power boilers, would be of no practical use.

The following classification was adopted:

A—Boilers using solid fuel, (a) steam, (b) hot water, both sub-classified by type of solid fuel.

B—Boilers using gas fuel, (a) steam, (b) hot water, both sub-classified for natural and manufactured gas.

C—Boilers using oil fuel, (a) steam, (b) hot water.

The committee has confined its recommendations to solid fuel equipments. It is understood that a committee of the American Gas Association has compiled a code for gas-fired boilers, which it is submitting to its members for approval. The boiler and the oil-burning equipment of Class C are not in general sold as an integral unit, but as a combined unit their testing specification will correspond more nearly to a gas-fired than to a solid-fuel equipment.

### PURPOSE OF THIS CODE

The committee found it necessary first to agree upon the purpose of the rating code for low-pressure heating boilers. The best method for rating boilers, as for any other article, depends on the purchaser's method or process of selection. It probably will be agreed that these may be listed as three:

(a) By experience, without any computation.

(b) By taking the square feet of radiation to be installed as radiators, and multiplying this by a safety factor to determine the highest rate of output required of the boiler.

(c) To compute the maximum rate of heat supply which will ever be required, which in general will occur on the coldest day during the heating-up period.

Item (a) may be neglected since it can be adapted to any method of rating. Items (b) and (c) are the same in reality, in that both aim to compute the maximum demand which is likely to occur. Granted then that the maximum heat requirements are determined, it is reasonable that the purchaser should want the boilers' catalog ratings to be given as their greatest allowable outputs.

Such a method is not the only possible one. Most methods of rating capacity are on the basis of using normal continuous outputs as the rating value, as with electrical motors and generators, and for power boilers as far as these can be said to rate capacity. Usually the standard continuous output capacity is given, accompanied by guarantees as to overloads. This is quite satisfactory since the demand on the apparatus usually can be limited so that the overload capacities are not exceeded, but the one most important factor in a heating installation is that the necessary maximum quantity of heat should be available when it is wanted, and, consequently, what may be called the overload capacity is of more importance than the normal output required. Even this might not interfere with using the normal output as the rating, if the ratios of the overload to the normal requirement were the same in all installations, which, however, they are not. A discussion as to what is meant by maximum output will be given later.

It should need no discussion to demonstrate that with any system of rating a purchaser should be justified in assuming that rating values as given for different makes should be comparable, and that if two catalogs each rate a boiler at the same capacity, then it can be assumed that both will give that output with at least some similar facility.

From such arguments as the foregoing the committee developed its definition of the purpose of the code, and stated it as:

The purpose of giving low-pressure heating boilers rating values as are defined by this code is limited to that of permitting comparisons between different boilers on the basis of their ability to take care of the maximum demand.

The period of maximum demand, for most installations, will not occur often or be of long duration. It is therefore legitimate that at these times the boiler should be worked to its maximum, safe, and allowable capacity. Granting this, it is then necessary to define what should limit the safe and allowable output.

It is advisable first to distinguish clearly between the limitations fixed by the boiler itself and those due to outside conditions. This committee limits the boiler construction to the smokehood, but not including the chimney.

The outside conditions that may limit the output are the chimney and the attention required. Consideration of both are necessary when selecting a boiler for a given installation, but they do not limit the capability of the boiler itself to give its maximum output. The chimney must be large enough to properly function with the boiler purchased, or a boiler must be purchased to suit the existing chimney, but it should not be a restriction on a large capacity being obtained from a boiler when the chimney size permits it, provided such capacity does not exceed that fixed by other limitations.

The limits of output will obviously be reached:

(a) If the boiler fails mechanically or suffers damage that weakens it. This can be considered as safeguarded and covered by the boiler specification, and need not be included as a rating code limitation.

(b) When no further increase can be obtained by increasing the draft at the smokehood. With boilers so built this only would occur at very high outputs, and would not be found in saleable types.

(c) If a steam boiler primes objectionably.

### PRIMING LIMITATION

The inherent limit of capacity of a steam boiler is, therefore, its priming point, and to give satisfactory operation, even for a short time, the quantity of water carried in the steam must be within reasonable limits.

The committee had little experimental data on the relation between the percentage of moisture in the steam and increasing output. Undoubtedly this will vary with different types, but in general the percentage of moisture remains low until a certain output is reached, when it begins to increase rapidly, and soon gives serious priming. The more correct test procedure would be to increase the output gradually until the priming point was reached, then operate the boiler just below this condition long enough to find the rate of

*This report, as here printed, formed the preamble to the code as presented at the semi-annual meeting, June, 1927.

evaporation. The permissible rated output, as fixed by priming, could then be specified as a safe percentage of this.

The committee reluctantly decided that the difficulties in making such a test did not warrant its adoption, and chose the steam separator method and fixed the permissible moisture as 2%.

Further limitations that could be imposed are:

(d) The fuel consumption, or its equivalent in efficiency.

(e) The temperature of the flue gases at the smokehood.

A method of rating, based on equal or similar efficiencies at the rated output, would be ideal in many respects, especially from the purchasers' viewpoint, but the efficiency at the times of maximum demand is of secondary importance. The most economical boiler will be the one which has the highest efficiency at the output corresponding to the seasonal average demand, which will be around 1/3 to 1/2 the maximum demand value. The tests to determine the efficiency of solid fuel boilers are difficult to make, taking 12 to 18 hrs., and a number of tests would be required to determine the rate of output at which a boiler must be operated to give a specified efficiency value. The committee, therefore, rejected efficiency as a rating limitation for boilers using solid fuels, although it considered that it might well be adapted to gaseous or liquid fuel ratings.

### FLUE-GAS TEMPERATURE LIMITATION

There are several reasons why the flue-gas temperature is a desirable limiting condition. For a given fuel and similar method of operating a boiler the relation between flue gas temperature and output is a straight line; if the temperature and output are plotted in the usual way, and the temperature for one output is known, then its probable value for any other load is given by the line drawn through the known point and the 220° F. point on the no-load axis. It also is comparatively simple and inexpensive to find the output corresponding to a given flue-gas temperature, as the test can be short and will give the value wanted directly, without the necessity of making several tests.

There are reasons also why there should be a limit to the maximum stack temperature permissible in heating boilers and furnaces which are installed under usual conditions. The user should be protected against the necessity of overheating his flue pipes—with its consequent fire risks—even though he cannot be prevented from doing it. The temperature of the flue gas is some approximate measure of the efficiency, and there is a value for the flue-gas temperature at the period of maximum demand which will insure the boiler operating at its maximum efficiency on the seasonal average demand.

The committee does not take the responsibility of fixing the allowable maximum temperature from a fire-risk standpoint, since it believes that this is the province of the fire underwriters, and they might permit it to vary with the method of installation. It believes that the allowable maximum value should be low enough to insure reasonable efficiency, and high enough to protect the user from having to purchase an unnecessarily large boiler.

The committee recognizes that there will be more difficulty in reconciling differences of opinion on the value to be specified for the flue-gas temperature than on any other feature of the proposed code. The limiting condition that "the average temperature during the period of test of the flue gases leaving the boiler shall not exceed 700° F." was adopted after careful consideration of replies received from the preliminary circular sent out by the committee.

Arguments can be advanced for the temperature being dependent on (a) the size of boiler, (b) fuel used, and (c) type of boiler, and that, therefore, there should be a table of limiting values. The stand the committee takes is that it would be of little consequence what value was used except for the fact that the rating value is associated by the code with the maximum demand requirements. The most needed reform in the method of publishing rating values is that the purchaser should have the assurance that all manufacturers use the same standard. That is necessary, but if, in addition, those values correspond to the recommended maximum output of the boiler, then there will be a still further advantage, and the rules for the proper selection of boilers more easily formulated.

Although the proposed code suggests a connection between rating and selection, yet it does not bind them together, and in reality only defines a method of rating. If it is adopted, and manufacturers so list their boilers, it will be possible to draw up a logical and definite set of rules for selecting boilers, and to modify these from time to time to give users the best equipments, both from a cost and operating standpoints. Such changes in the rules for selecting will not affect the manufacturers' rating values or call for more tests.

It can be assumed that rules for selection will be based on the principle of computing the total heat losses and multiplying these by a factor, to determine the rating of the boiler required. The rules can be made as comprehensive and detailed as the state of knowledge permits, and can cover size of boiler, fuel, type of building and other factors.

Arguments have been advanced to the committee that the limiting flue-gas temperature should vary with the type of boiler. It could find, however, no justification for such a proposal. It is true that some types of boilers have larger areas of heating surface than others, and that consequently they will have lower stack temperature for the same output and their rating may be fixed by their priming at a lower flue-gas temperature than the maximum allowable. The opportunity is open to manufacturers to publish the actual flue-gas temperature that will exist at the rated load, and the code only states that it shall not exceed the stated maximum.

### $CO_2$ AND CO LIMITATIONS

The temperature of the flue gases is affected by the excess air they contain, and it might be expected that the temperature would always be lower as the percentage of excess air increases. Such an expectation is confirmed by theory when it does not take account of the relative amount of heat given up by the hot gases through radiation, or the change of their path over the heating surfaces. It is not always borne out, however, and the reverse often has been found to occur in power boilers. There is a lack of experimental data for heating boilers, but it is probable that some types may show a reduction and others an increase. Examples of tests showing illustrations of both increase and decrease were available.

The committee considered that it was necessary to guard against a condition being imposed by damper adjustment that would lessen the fairness of the comparisons between different boilers. It believes that the inclusion of the flue-gas analysis is advisable and necessary, and that, in particular, it will guide the test crew in making the best damper settings, and will collect valuable data which will enable more definite damper adjustment instructions to be given to the users of the equipment.

With a given fuel and with no carbon monoxide (CO) in the flue gases the percentage by volume of carbon dioxide ($CO_2$) present determines the percentage of excess air. The $CO_2$ is, therefore, a more direct method of limitation and was the one adopted.

Each 1% of CO represents a loss of from 4% to 5% in efficiency, and it is logical that the test should be run with such damper adjustments that the quantity of CO present in the flue gases is low. The possibility of doing this is dependent, sometimes, on there being sufficient stack draft available because it may be necessary to partly close the ash-pit damper in order to increase the quantity of supplementary air over the fuel bed. The limitation of a maximum of 1% to the average CO during the period of test is liberal. Test records show that there was no difficulty in keeping the CO to 0.5% even when the firing restrictions were more severe than those specified in this code.

### FUELS FOR STANDARD RATINGS

With a given flue-gas temperature the output of a boiler will vary with the type of coal used. Ideally, therefore, each boiler should be given a rating test with each coal that may be used in it. If a sufficient number of such tests had been made it would be expected that factors could be established from which the outputs with all coals could be predicted, provided it had been determined with one. Such data are not available, and a compromise was arrived at by establishing the two standards—the an-

thracite rating and the bituminous rating.

It was considered advantageous to group anthracite and coke together, and to permit of their being alternative fuels in the testing. Published tests show that they give approximately the same results.

Since bituminous coals vary widely in their burning characteristics it was necessary to fix on one type which would be representative. It is known that the burning characteristics of bituminous coals cannot closely be predicted from the proximate or ultimate chemical analyses, and there is not at present any agreed-upon laboratory methods of numerical scales by which burning characteristics may be expressed. They are, therefore, designated by coal bed and the district where mined.

The bituminous coal which the committee selected has a fairly wide distribution, and has medium coking qualities and length of flame. It was necessary to specify limits for the percentage of volatile matter because the coal beds are so extensive that the nature of the coal varies. Coals which have equivalent burning characteristics to that specified are allowed, but the committee considers that special tests will be required before the use of others can be authorized.

The committee considers that the determination of these two standard ratings is sufficient, and that allowable outputs when other coals are used can be covered by the rules for selecting boilers. The ability to formulate such rules will depend on the accumulation of further test data.

Little restriction is put on the size of fuel permissible. The best size will depend on the size of boiler and its design, and it is sufficient to leave it to the manufacturers. The size of fuel used, especially if it be non-caking, very materially may affect the results obtained unless the dampers have the capability to be and are properly adjusted.

### TEST SPECIFICATIONS

The test specification has been kept simple and is direct in its method. The intent of each item in it is obvious and needs little comment.

The rating test in no way attempts to determine the efficiency, and is limited to finding the output given by the boiler when operating within the limiting conditions. This testing specification does not conflict with that adopted by the society in 1923, because the objectives of the two are different. The time required for the official test is short, and there should be no difficulty in completing a test in an 8-hr. day, provided the testing force has gained the necessary manipulative ability.

The advantages of using test method A, and measuring the weight of steam evaporated by condensing it in a surface condenser, are obvious. Any error due to a difference between the height of the water level in the test period is negligible.

The committee limited the instructions, advice and restrictions on apparatus, instruments and manipulations, to those which are pertinent to the main objectives of the test. It feels, however, that a Code on Instruments and Apparatus applying to heating boilers is needed, but thinks that it should be drawn up so as to cover all codes, and that the inclusion of separate instructions in each code is inadvisable and inefficient.

### HOT WATER BOILERS

The code has been limited to steam boilers. The committee had no information before it as to how many manufacturers test their hot water boilers when assembled for that use. It understands that this rarely is done, and that it is the practice to determine the output when operating as a steam boiler, and to translate that into the equivalent hot water radiation.

The *limiting conditions* which should be used with hot water boilers were discussed, but it was decided that it would be advisable to have a separate code and not complicate that for steam boilers. The flue-gas temperature and its composition limitations would be the same as in this code. Further consideration will be required on:

| BOILER | OUTPUT – STEAM – SQ. FT. | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 650 | 700 | 750 | 800 | 850 | 900 | 950 | 1000 | 1100 | 1200 | 1300 | 1400 | 1500 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NUMBER | OUTPUT – B.T.U. IN 1000'S | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 | 156 | 168 | 180 | 192 | 204 | 216 | 228 | 240 | 264 | 288 | 312 | 336 | 360 |
| I-S-4 | TIME AVAIL. FUEL WILL LAST – HOURS | 19.4 | 14.7 | 11.9 | 9.9 | 8.4 | 7.3 | 6.5 | 5.8 | 5.2 | 4.8 | | | | | | | | | | | | | |
| | STACK GAS TEMPERATURE DEG. F. | 330 | 375 | 418 | 465 | 510 | 555 | 600 | 647 | 692 | 740 | | | | | | | | | | | | | |
| | EFFICIENCY PER CENT | 66.3 | 67.0 | 67.5 | 67.5 | 67.2 | 66.8 | 66.2 | 65.5 | 64.5 | 63.5 | | | | | | | | | | | | | |
| | DRAFT TENSION INS. OF WATER | .028 | .030 | .038 | .047 | .057 | .070 | .087 | .110 | .140 | .185 | | | | | | | | | | | | | |
| | CHIMNEY SIZE INCHES | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x12 | 8x12 | | | | | | | | | | | | | |
| | CHIMNEY HEIGHT FEET | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | | | | | | | | | | | | | |
| I-S-5 | TIME AVAIL. FUEL WILL LAST – HOURS | 27.0 | 20.4 | 16.4 | 13.7 | 11.7 | 10.2 | 9.0 | 8.0 | 7.2 | 6.5 | 5.9 | 5.3 | 5.0 | | | | | | | | | | |
| | STACK GAS TEMPERATURE DEG. F. | 305 | 340 | 377 | 415 | 450 | 487 | 525 | 562 | 600 | 635 | 672 | 710 | 745 | | | | | | | | | | |
| | EFFICIENCY PER CENT | 67.5 | 68.4 | 68.8 | 69.0 | 68.8 | 68.4 | 68.0 | 67.3 | 66.5 | 65.7 | 65.0 | 64.0 | 63.0 | | | | | | | | | | |
| | DRAFT TENSION INS. OF WATER | .027 | .029 | .035 | .040 | .045 | .055 | .066 | .080 | .098 | .121 | .147 | .180 | .220 | | | | | | | | | | |
| | CHIMNEY SIZE INCHES | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | | | | | | | | | | |
| | CHIMNEY HEIGHT FEET | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | | | | | | | | | | |
| I-S-6 | TIME AVAIL. FUEL WILL LAST – HOURS | | 26.0 | 21.0 | 17.5 | 15.0 | 13.1 | 11.6 | 10.4 | 9.4 | 8.5 | 7.8 | 7.2 | 6.8 | 6.1 | 5.7 | 5.3 | 5.0 | | | | | | |
| | STACK GAS TEMPERATURE DEG. F. | | 323 | 355 | 387 | 420 | 450 | 483 | 515 | 547 | 578 | 615 | 643 | 675 | 707 | 740 | 770 | 803 | | | | | | |
| | EFFICIENCY PER CENT | | 69.5 | 70.0 | 70.2 | 70.2 | 70.0 | 69.7 | 69.3 | 68.8 | 68.3 | 67.7 | 67.0 | 66.3 | 65.5 | 64.7 | 64.0 | 63.0 | | | | | | |
| | DRAFT TENSION INS. OF WATER | | .028 | .032 | .037 | .040 | .045 | .051 | .060 | .068 | .080 | .095 | .110 | .130 | .155 | .187 | .225 | .270 | | | | | | |
| | CHIMNEY SIZE INCHES | | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | | | | | | |
| | CHIMNEY HEIGHT FEET | | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 35 | 35 | 35 | 35 | | | | | | |
| I-S-7 | TIME AVAIL. FUEL WILL LAST – HOURS | | | 26.0 | 21.6 | 18.5 | 16.2 | 14.4 | 12.9 | 11.7 | 10.7 | 9.8 | 9.0 | 8.4 | 7.8 | 7.3 | 6.8 | 6.4 | 6.0 | 5.4 | | | | |
| | STACK GAS TEMPERATURE DEG. F. | | | 348 | 370 | 408 | 428 | 457 | 487 | 515 | 545 | 575 | 603 | 632 | 660 | 690 | 720 | 748 | 760 | 835 | | | | |
| | EFFICIENCY PER CENT | | | 71.0 | 71.5 | 71.6 | 71.7 | 71.7 | 71.5 | 71.3 | 71.0 | 70.5 | 70.0 | 69.5 | 69.0 | 68.3 | 67.6 | 67.0 | 66.4 | 65.0 | | | | |
| | DRAFT TENSION INS. OF WATER | | | .030 | .035 | .035 | .040 | .045 | .050 | .055 | .062 | .070 | .083 | .095 | .110 | .130 | .152 | .183 | .217 | .310 | | | | |
| | CHIMNEY SIZE INCHES | | | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 12x12 | | | | |
| | CHIMNEY HEIGHT FEET | | | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | | | | |
| I-S-8 | TIME AVAIL. FUEL WILL LAST – HOURS | | | | 25.5 | 21.8 | 19.2 | 17.0 | 15.3 | 14.0 | 12.7 | 11.7 | 10.8 | 10.0 | 9.4 | 8.7 | 8.2 | 7.7 | 7.3 | 6.5 | 5.8 | 5.3 | | |
| | STACK GAS TEMPERATURE DEG. F. | | | | 365 | 392 | 420 | 450 | 475 | 503 | 530 | 560 | 587 | 615 | 642 | 670 | 700 | 725 | 755 | 810 | 867 | 923 | | |
| | EFFICIENCY PER CENT | | | | 71.9 | 72.2 | 72.5 | 72.5 | 72.5 | 72.4 | 72.2 | 72.0 | 71.5 | 71.2 | 70.7 | 70.2 | 69.8 | 69.3 | 68.7 | 67.5 | 66.3 | 65.0 | | |
| | DRAFT TENSION INS. OF WATER | | | | .032 | .032 | .035 | .037 | .040 | .045 | .051 | .058 | .065 | .075 | .085 | .098 | .110 | .124 | .145 | .190 | .255 | .330 | | |
| | CHIMNEY SIZE INCHES | | | | 8x8 | 8x8 | 8x8 | 8x8 | 8x8 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 12x12 | 12x12 | | |
| | CHIMNEY HEIGHT FEET | | | | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | | |
| I-S-9 | TIME AVAIL. FUEL WILL LAST – HOURS | | | | | 25.2 | 22.2 | 19.7 | 17.8 | 16.2 | 14.8 | 13.6 | 12.6 | 11.7 | 11.0 | 10.3 | 9.7 | 9.1 | 8.6 | 7.7 | 7.0 | 6.4 | 5.8 | 5.4 |
| | STACK GAS TEMPERATURE DEG. F. | | | | | 385 | 413 | 440 | 467 | 495 | 520 | 550 | 578 | 604 | 630 | 658 | 685 | 712 | 740 | 795 | 850 | 905 | 960 | 1012 |
| | EFFICIENCY PER CENT | | | | | 72.6 | 72.9 | 73.0 | 73.1 | 73.1 | 73.0 | 72.9 | 72.6 | 72.5 | 72.2 | 71.9 | 71.5 | 71.2 | 70.8 | 70.0 | 69.0 | 68.3 | 67.2 | 66.2 |
| | DRAFT TENSION INS. OF WATER | | | | | .030 | .032 | .033 | .036 | .040 | .045 | .050 | .055 | .061 | .068 | .077 | .085 | .095 | .107 | .132 | .160 | .198 | .245 | .298 |
| | CHIMNEY SIZE INCHES | | | | | 8x8 | 8x8 | 8x8 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 8x12 | 12x12 | 12x12 | 12x12 | 12x12 |
| | CHIMNEY HEIGHT FEET | | | | | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 | 35 |
| BOILER | OUTPUT – STEAM – SQ. FT. | 150 | 200 | 250 | 300 | 350 | 400 | 450 | 500 | 550 | 600 | 650 | 700 | 750 | 800 | 850 | 900 | 950 | 1000 | 1100 | 1200 | 1300 | 1400 | 1500 |
| NUMBER | OUTPUT – B.T.U. IN 1000'S | 36 | 48 | 60 | 72 | 84 | 96 | 108 | 120 | 132 | 144 | 156 | 168 | 180 | 192 | 204 | 216 | 228 | 240 | 264 | 288 | 312 | 336 | 360 |

**Tabulation of Boiler Tests Submitted by "Old Timer," Whose Comments Appear on the Next Page**

(a) What should be the test limits for the temperature of the inlet and outlet water?

(b) Should there be limitations on the ease of flow of the water through the boiler—that is, freedom from water-hammer knocks?

(c) Should the hydraulic flow resistance be measured, and should this be included in the record of the rating test?

MANUFACTURERS' CATALOG DATA

Though the code strictly is limited to the rating of boilers, it was necessary for the committee to discuss the connection between rating and selection, and to consider what data manufacturers' catalogs should supply in order that a code for selection could be devised. It does not come within the scope of the committee's work to make definite recommendations, but it is thought advisable to append some tentative suggestions.

The ideal method would be to have complete test data on each boiler in the form of curves showing the efficiency, flue-gas temperature, stack draft, and length of firing period against output. Such complete information would undoubtedly be useful at times, but is cumbersome for ordinary catalog publication. Under the ordinary conditions of selecting a boiler it is sufficient to know:

(a) The maximum capacity of rating.

(b) The draft required for maximum capacity, or the chimney size. (Under the rating code the stack temperature will be known, or should be given if less than the allowable maximum. The weight of flue gas approximately can be estimated from the output and fuel).

(c) The efficiency at average normal output.

(d) The firing period at average normal output.

There is some question as to what fraction of the maximum output should be taken for the "average normal output." It might correspond to the average output during the heating season, but as an all-around consideration it was thought that 50% of the rated output would be correct.

It would, therefore, only be necessary to make the rating test and one full efficiency test on each boiler, which would thus be less costly than making the four or five efficiency tests required for a complete set of curves.

If the rated output and its stack temperature and draft, and also the full efficiency test data at the 50% rating are known, the values for stack temperature, draft and firing period can very closely be predicted for any intermediate output, at least as closely as will be the values occurring in service operation.

SUMMARY AND CONCLUSION

The committee submits the proposed rating code believing it to be a reasonable solution of the problem, but its success depends on more than its approval by the society in that it must be adopted and used by manufacturers and contractors. For this reason the committee would recommend that its proposals thoroughly be discussed, and that the report be referred back to the committee for further consideration unless substantial agreement be obtained.

All codes require the test of experience and should be modified, as necessary, or should be issued as tentative codes until experience has proved their correctness.

It recognizes that the code arbitrarily fixes the maximum flue-gas temperature which shall occur, and that the code recommends that boilers shall be so selected that this will not be exceeded. While all will agree that there is some advisable maximum value, yet there can be legitimate disagreement on what this should be, whether it should be the same for all installations, or as to what body or authority should have the final decision. No such code has legislative powers and all it can do is to recommend. It cannot prevent manufacturers from listing their boilers as having overload capacities greater than the standard rated output, nor can it prevent users from operating their installations under dangerous conditions or at any rate that they can obtain from them.

The fact that the committee knows of no alternative method being proposed, and the fact that its preliminary circular letter brought in no suggestions for changing the principles on which this code is based, would indicate probability of agreement.

Submitted by the Committee

ALFRED KELLOGG, *Chairman*
F. C. HOUGHTEN
S. R. LEWIS
P. NICHOLLS
L. E. SEELEY

# Are These Comments Constructive?

## Letters From Four Sources Express Divergent Opinions and Embody Relevant Suggestions

DIFFICULTIES in securing commitments on the A.S.H. & V.E. Boiler Rating Code have been on a par with those experienced by the country dentist in extracting a well-embedded molar. A reluctance to voice individual opinions appears on almost every hand. Four, only, have been received; the writers of two comments desire to remain unidentified, one indicates no desire in the matter, and one is willing to be quoted.

The code has been "accepted in principle," from which it is fair to assume that the A.S.H. & V.E. has determined that there shall be a code for rating low-pressure heating boilers; that the special committee appointed to formulate the code has produced a workable instrument with a logical foundation, and that, through a desire to iron out every possible point of contention, a half-year period would be allowed in which points of divergence could be smoothed out by the committee, prior to a formal "adoption" of the code.

Nearly half of the available time has passed, and, during the latter half, the pages of THE HEATING AND VENTILATING MAGAZINE are available for the presentation of constructive thoughts that will be of value to the committee, and, through it, to the industry.

One letter reads:

HEATING BOILERS—TO RATE OR NOT TO RATE

"The industrial power-boiler picks up its uniform load in the early morning and carries it steadily without appreciable fluctuation until the end of the run—receiving continuous attention—operating with uniform fuel consumption, steam output, draft tension and efficiency.

"The daily average performance of a locomotive boiler substantially is similar to that of an industrial power boiler.

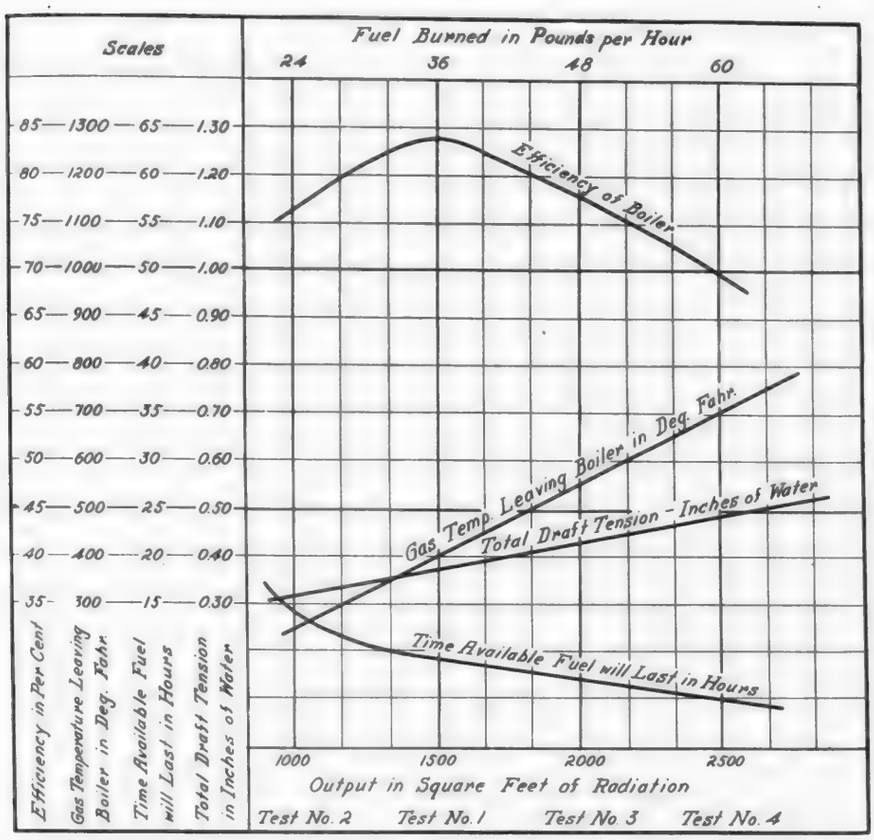
"The daily winter heat output of a low-pressure heating boiler *is ever changing*, ranging from a mere vapor to a maximum drive, responsive to outside temperature changes. This fluctuating performance is effected by automatically *retarding or accelerating the combustion of the fuel.*

"In a heating boiler every change in the rate of combustion of any solid fuel changes consistently the number of hours the fuel will last without recharging; also the quantity of B.T.U. developed; the efficiency of performance; the stack temperature and the chimney dimensions. This is shown on the chart submitted, which affords a graphic picture lime-lighting the wide flexibility of a boiler's continuous performance.

"A study of the data on this chart will disclose the numerous material changes in values of all of the vital factors consequent upon *retarding or accelerating the combustion of the fuel.*

"A falling outside temperature increases fuel consumption, increases air required, increases chimney dimensions, increases out-put, increases stack temperature, decreases the time fuel will last and decreases efficiency.

"A rising outside temperature decreases fuel consumption, decreases air required, decreases chimney dimensions,




**Set of Test Curves of Low-Pressure Heating Boiler Using Anthracite Coal at Varying Rates of Combustion**

The curves indicate that, for this boiler, for maximum efficiency, stack temperatures would not exceed 450° F.

decreases output, decreases stack temperature, increases the time fuel will last and increases efficiency.

"A critical diagnosis of the values of the variety of phases of the dominant factors shown on the chart may impel those who question the dependability of heating-boiler catalog ratings to invite the heating-boiler maker to abandon the present practice of rating and substitute certified performance charts similar to this specimen."

"Old Timer."

WHAT SHOULD BE THE LIMITING TEMPERATURE OF FLUE GASES?

One engineer writes:

"I object to paragraph two under Rating Denfiitions, for the following reasons:

"I have found that a flue temperature of 400° is the most economical condition under which to obtain ratings. Please find enclosed blue print of a certain recent test. (See curves above.) This substantiates my criticism of the 700° average flue temperature.

"My principal objections to this high flue temperature are: If maintained during a test, the firing periods cannot be over a half hour apart, which means constant attention; also that it allows manufacturers to place upon the market a short-pass boiler, which not only is uneconomical from a fuel point of view, but also does not give the user the advantage of having heat when it is most required without the disadvantage of constant firing.

"From the above method of reasoning, I advise that the flue temperature during tests be limited to 450°."

IS A QUART MEASURE POSSIBLE?

A writer, with a broad background, and intimate knowledge of the industry, writes:

"There is a very far cry between a theoretical discussion by engineers and the practical manufacture of boilers, and I say this without the slightest prejudice to either side. I do think engineers and heating contractors, architects and owners are entitled to full performance data from the manufacturer of the particular boiler that that manufacturer makes, but to attempt to put all these various boilers, various types and various constructions into a common bushel-basket and then draw them out, quart by quart, is impossible."

At the last moment there was received, from the chief engineer of an important boiler manufacturer, a most complete analysis of the code, with a large number of suggestions for changes. Unfortunately it arrived too late for inclusion in this number and will appear in the October issue.

## A. P. H. A. Convention to Have Paper on School Ventilation

Meeting for the fifty-sixth annual convention at the Hotel Gibson, Cincinnati, O., October 17-21, the American Public Health Association has found it necessary to extend the usual convention period on account of the comprehensive program that has been prepared.

In addition to the two general sessions, there will be six special sessions, four joint sessions, twenty-two meetings of the nine sections, and eight dinner and luncheon gatherings. Approximately 150 speakers will appear on the program.

Portraying the extreme conditions and problems that arise under extraordinary circumstances, two papers are of particular interest. The first by J. H. O'Neill, of the Louisiana State Board of Health, who was in charge of the sanitary relief measures during and following the Mississippi flood, and the second by J. A. LePrince, on mosquito production in the Mississippi Valley flood area, and the many problems which were occasioned and still are present due to the flooding of vast areas in the malaria district.

Thomas J. Duffield, executive secretary of the New York Commission on Ventilation, will present a paper entitled, "School Ventilation and its Effect on the Health of the Pupil." It is stated that this is a preliminary report on certain recent investigations, with some tentative results.

## A New Lumber Fireproofing Process

After several years of laboratory experimentation, a new process for fireproofing lumber has been developed by H. A. Dorr, a fireproofing expert. Maple, fir, yellow and white pine, and white oak lumber, treated by the new process, have been tested by the Columbia University Testing Laboratory, and have been found acceptable for use in the interior construction of fireproofed skyscrapers by the Bureau of Buildings, of New York City, whose regulations are regarded as the most stringent in the country.

The new process involves the impregnation of lumber with a secret non-poisonous chemical solution, after which it is kiln-dried for a period not exceeding 48 hours, according to the type of wood. Apparatus has already been constructed which treats lumber up to 20 ft. in length, and 1¼ in. in thickness. The treated wood, it is stated, retains its natural color, and can be worked as easily as plain wood, without injury to machines or tools. It accepts paints, varnish, shellac or other veneers, and does not warp or rot.

Successful results, it is added, have been secured by applying the process to Celotex, Insulite, Ten test, Masonite, and similar insulating materials.

The new process will be commercially developed by the Fireproofing and Drying Lumber Corporation, Brokaw Bldg., New York, using the trade-mark, "Dorr Fireproofing Process." Present indications are that the treatment will not increase wallboard cost more than 10%.

# Gas Heats Large Buildings

## Office and Public Buildings and Apartments Form New Field With Radiation Loads Up to 40,000 Sq. Ft.

**New Office Building of the Boston Consolidated Gas Company, Heated With Gas**

Contents, 2,175,000 cu. ft.; installed radiation 34,500 sq. ft. There are six Ideal boilers in the boiler room.

CONCERTED action by gas companies throughout the United States to acquire house-heating loads by the establishment of special rates for this purpose has, as a matter of course, opened up a somewhat different field—that of the larger installations required for apartment houses, public buildings, and moderate-sized office buildings.

Installations of this sort involve no new engineering practice. It is merely a matter of installing enough boiler units—usually the largest possible combination of sections—to generate the necessary amount of steam. Automatic temperature-control acts to cut down, or entirely shut off, the flow of gas to any one or more boilers that may be in operation, and, when such boiler, or boilers, entirely is cut off, the stand-by loss for the period of inactivity is practically zero. This fact coupled with the tremendously high heat-production efficiency of the gas-fired boiler offers a possibility of providing heat for a building of this class, at a cost commensurate with that secured when burning oil. It even may be possible that the superior efficiency of the gas-fired boiler largely or entirely will offset the higher fuel cost of the gas per B.T.U., and thus secure to the owner the advantages of the gas-fired job without exacting a premium in fuel cost.

Sufficient data have not yet been secured from installations of this kind to determine accurately the relative costs of heating with oil and gas.

### GAS-FIRED BOILERS IN HUB'S NEW OFFICE BUILDING

The buildings and illustrations here shown are an index of what may be considered typical in this new field. The building of the Boston Consolidated Gas Company has just been completed and is of particular interest by virtue of its architectural beauty, and because it is the first building of this type in the East to be heated with gas.

This installation consists of six Ideal gas-boilers, each fitted with 20 burners. Each boiler is adjusted to burn 4300 cu. ft. of gas per hour, or a total of 25,800 cu. ft. per hour for the entire installation. Based upon the hourly heat-loss for the building, slightly less than 18,000 cu. ft. of gas will be required in zero weather. In mild weather the building will be heated by one or more boilers, as occasion demands.

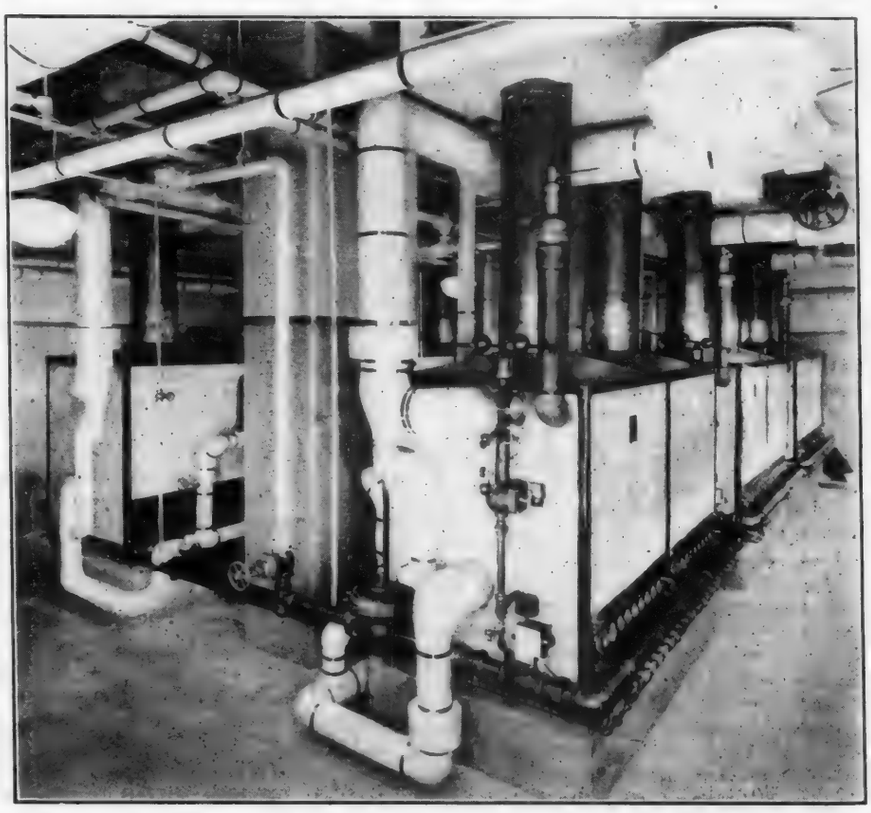
Among the safety features of this installation are thermostatic pilots which instantly and automatically shut off the gas from any boiler in which the pilot light has been extinguished. Low-water devices act to cut off the fuel in case the water level falls below the safety point, and pressure controls will limit the steam pressure to a predetermined figure.

It is estimated that this plant will consume approximately 30,000,000 cu. ft. of gas for the normal heating season, which is about the quantity required to heat 75 average homes. A Pendleton system of automatic heat-control is part of the equipment. This automatically provides different periods of firing, as required by outside weather conditions.

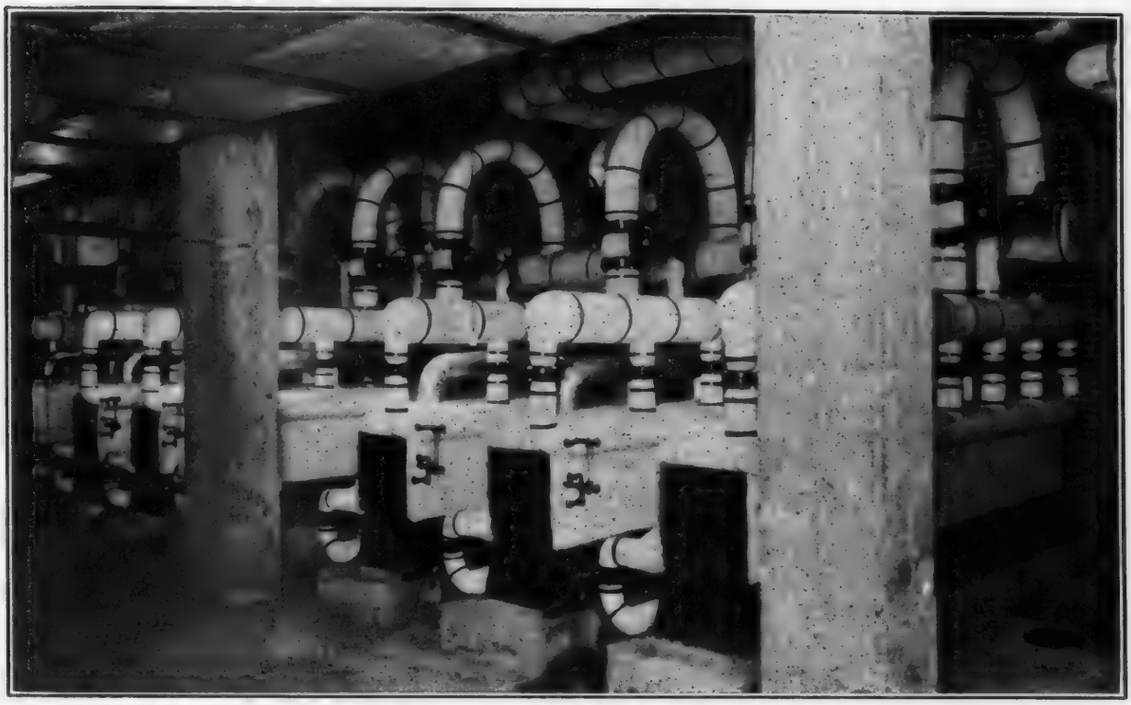
The radiation installed is equivalent to 34,000 sq. ft. of direct radiation, although a portion of this represents indirect radiation, with the necessary blowers and air ducts.

### LOS ANGELES CHAMBER OF COMMERCE GAS BOILERS HEAT 40,000 SQ. FT. OF RADIATION

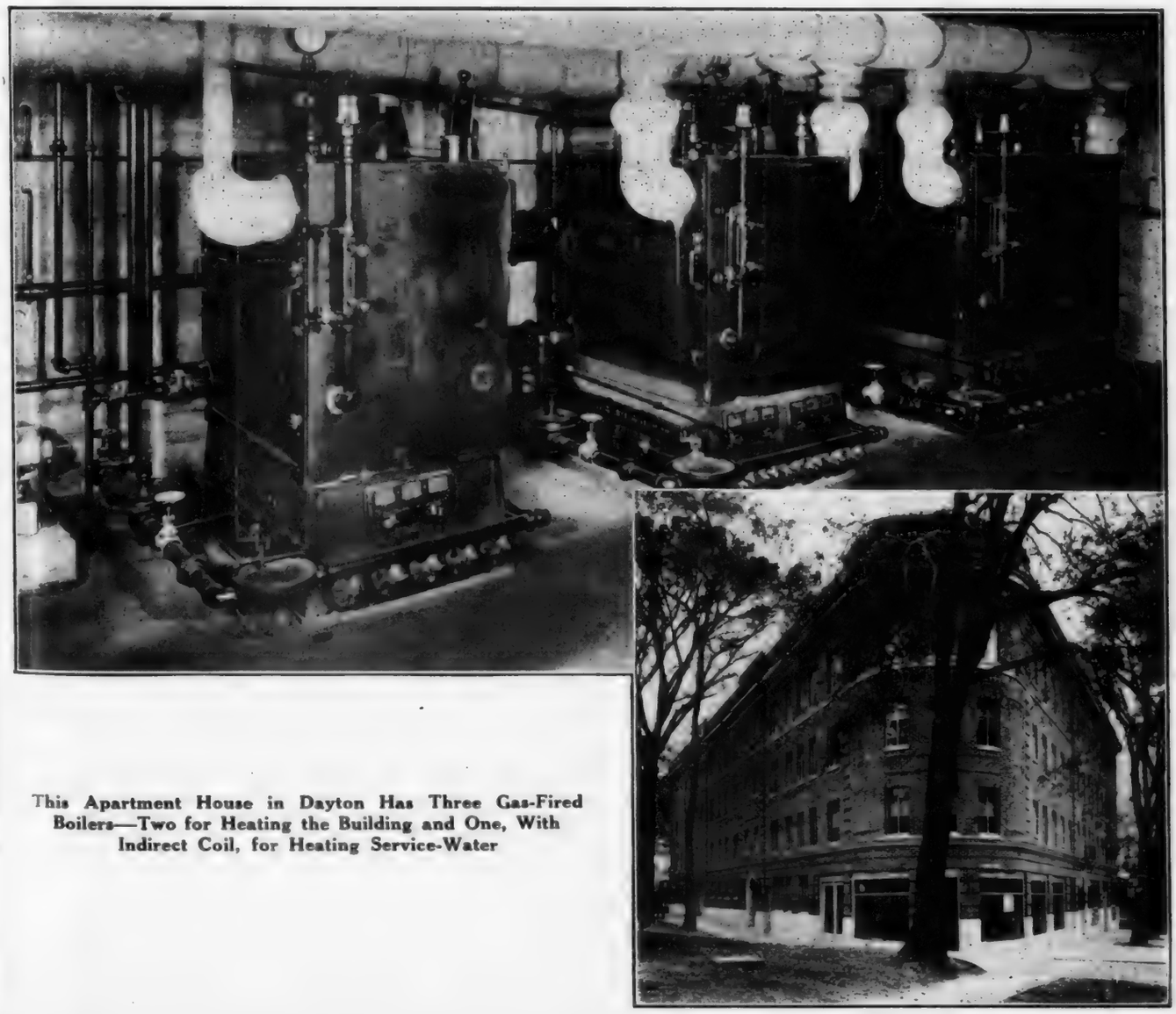
The installation in the Los Angeles Chamber of Commerce building probably is the outstanding gas-fired job in the Far West, where gas is utilized for heating to an extent unknown in the eastern states. This battery consists of seven Peerless boilers connected to an equivalent of 40,000 sq. ft. of radiation. The other buildings are typical of small apartment and commercial buildings heated with gas.



**Back-to-Back Battery of Ideal Gas-Fired Boilers Heating the Consolidated Gas Company Building, Boston**



Six Peerless Gas Boilers Supply Steam For 40,000 Sq. Ft. of Radiation in Los Angeles Chamber of Commerce



This Apartment House in Dayton Has Three Gas-Fired Boilers—Two for Heating the Building and One, With Indirect Coil, for Heating Service-Water

## Gas Rates Reduced by New York Consolidated Companies to Encourage Larger Consumption

Inducement rates have been announced by the Consolidated Gas Co., of New York, and seven of its affiliated companies. For those using gas for house heating a special rate has been named. This will be available only between September 1 and May 1, while gas supplied for industrial purposes, in wholesale quantities, will have a special low rate, when it is used entirely outside of that period. People living in Manhattan, and all of the Bronx and Queens, served by the Consolidated Gas Company, will reap the benefit of this readjustment.

For all the gas furnished to a customer using gas for heating the rate will be a graduated annual unit charge per square foot of radiation surface, in addition to 7½ cents per 100 cu. ft. of gas metered, such unit charge being payable in six equal monthly installments, beginning with the first bill rendered on or after November 1 in each year.

In the case of wholesale customers, the rate will be $1.20 for the first 200 cu. ft. or less of gas, per meter, per month, in addition to 6 cents per 100 cu. ft. for all additional quantitics of gas metered, the minimum charge during this period being $1.20 for the first 200 cu. ft. or less of gas, per meter, per month.

Adoption of this new rate already has been announced by the Consolidated Gas Company of New York; the Astoria Light, Heat and Power Company; New Amsterdam Gas Company; East River Gas Company of Long Island City; Central Union Gas Company; Northern Union Gas Company; the Standard Gas Light Company of the City of New York; and the New York and Queens Gas Company. Other organizations connected with the consolidation are expected to soon follow in the footsteps of their predecessors. Among the next group, it is thought, will probably be the Bronx Gas and Electric Company, the Westchester Lighting Company, the Northern Westchester Lighting Company, and the Peekskill Lighting and Railroad Company.

## Wayne Company Initiates Commendable Practice

Evidences of broad-mindedness that augur well for future development are manifested in a policy established by the Wayne Co., Fort Wayne, Ind.

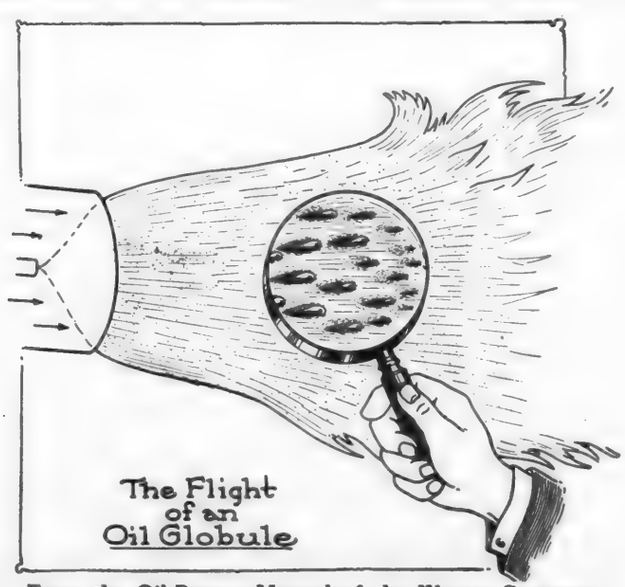
After having expended nearly a year in the preparation of an oil-burner sales and service manual, this company has sent advance copies to executives of the leading oil-burner manufacturers for information, comments and criticism. This manual is not designed for public consumption; its function is to serve as a compendium for salesmen, service men and others working in the interest of the Wayne Company. The dominating feature of the book is frankness and honesty, and there is a noticeable absence of "blah-blah" tending to prove that the Wayne burner is the best burner built.

The first 26 pages of the book are devoted to general subjects, such as the acceptance of oil as a domestic fuel, safety of oil fuel, the principles of fuel-oil combustion, various types of heating systems, how to figure radiation, how to estimate the capacity of warm-air heating pipes, and how to determine the proper size of burner to install. It is interesting to note that in the discussion of safety, instead of endeavoring to show that the Wayne burner is "absolutely safe," there is presented the tabulation of oil-burner fires reported by the National Fire Protection Association, as first presented in THE HEATING AND VENTILATING MAGAZINE, for December, 1926.

It is also noteworthy that the writers of this manual have taken the initiative in presenting an accurate story of combustion principles, copying, verbatim, portions from "Some Thoughts on the Combustion of Oil Fuel," that appeared in recent issues of THE HEATING AND VENTILATING MAGAZINE. Four pages only are devoted to this subject. Yet the Wayne salesmen can, from a study of this portion, equip themselves intelligently to tell an inquiring prospect the principles on which his burner operates.

Following this general dissertation, the installation of the Wayne burner is taken up step by step in 17 parts. Such care has been given to the preparation of this part of the manual that it is difficult to conceive of an intelligent installation man going astray after following the instructions. Likewise the service section covers its subject in an exhaustive way.

The 136 pages are copiously illustrated with line cuts and halftones exceptionally well rendered. This manual represents an important turning-point in the trend of oil-burner development, breaking drastically away from the vagaries and inaccuracies that characterized much of the oil-burner literature of two years or more ago.




From the Oil-Burner Manual of the Wayne Company

## Broadway Star Dramatizes Vacuum Valve

"The Heat Thief"—a story about valves—is a novel film which the Hoffman Specialty Company has produced with Ann Pennington as the star. As a plot, the battle of steam and air in radiators is depicted, which centers around a typical heating contractor. His experiences after he has installed a heating plant are causing him great trouble and much chagrin. In addition to showing his bungling effort to make repairs, there is a vivid picturization of the actual conditions within the steam system, both when ordinary air-venting valves are used, and after they have been replaced by Hoffman No. 2 vacuum valves.

This may be the beginning of a new use of the film for educational and publicity purposes.

## Plans for T. F. B.'s $500,000 Campaign

At a recent meeting of the executive and budget and program committees of the National Trade Extension Bureau, the question of completing the financing of the enlarged activities of the bureau, was the principal topic of discussion.

It was decided by the committees that, in seeking additional subscriptions for the $500,000 fund which is desired for 1928, work be concentrated in nine key cities and localities, and a local chairman be in charge of each district. Cities selected are: Chicago, Detroit, Cincinnati, Boston, New York, Baltimore, Philadelphia, Pittsburgh and Cleveland. Chairman, proper quotas and the materials which will be required in the campaign, were all considered at the meeting.

## AIR CONDITIONING

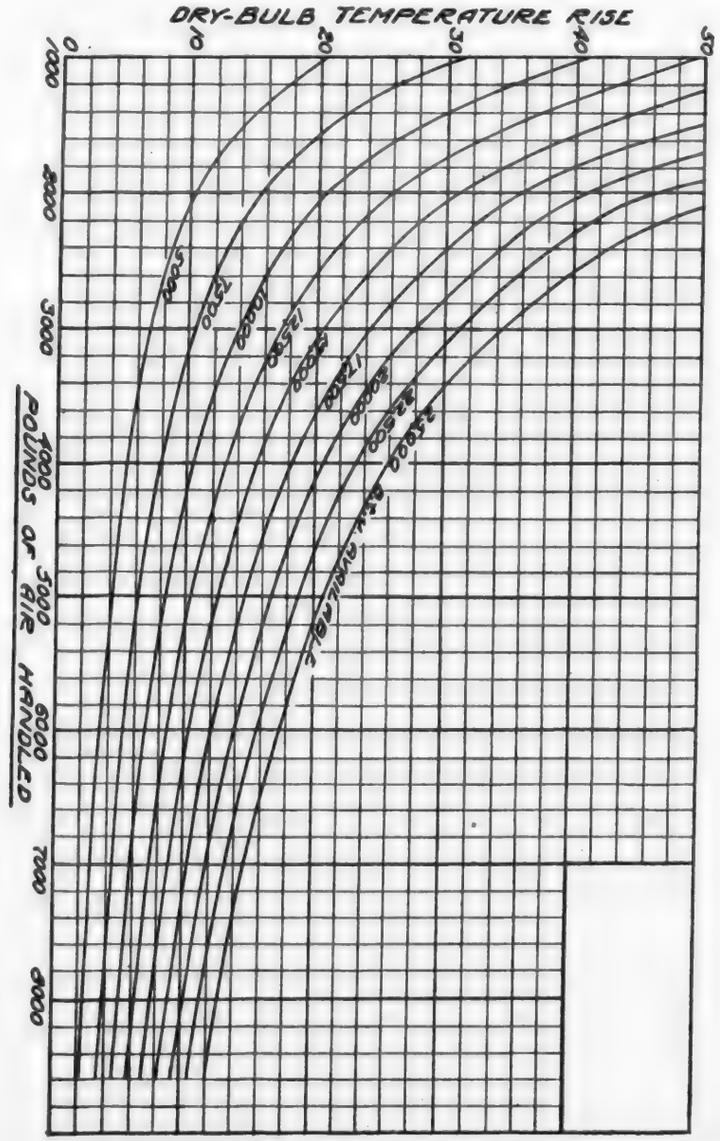
### How to Use Dry-Bulb Temperature Rise Chart

Data Sheet No. 20-D shows the relation between the quantity of air introduced and the rise in dry-bulb temperature, due to the total of all heat sources, including heat conducted through walls, heat given off by occupants, heat from lights, etc.

Example: Assume that it is required to find the temperature of air introduced into a theatre necessary to maintain a temperature of 75° F. in the breathing zone. The sum of all heat sources is 20,000 B.T.U. per minute, and 5500 lbs. of air per minute are introduced. Locate the 5500 lbs. on the horizontal scale, at the bottom of the chart, and pass vertically upward to the point of intersection with the 20,000 B.T.U. line. From this point of intersection pass horizontally to the scale on the left border and read 15° rise. Since the breathing zone is to be maintained at 75° F., air must be introduced at 15° below this, or 60° F. in order to absorb all heat and not rise more than 15°.

O. W. Armspach.

AIR CONDITIONING—How to Use Dry-Bulb Temperature Rise Chart. | No. 20-E




AIR CONDITIONING—Dry-Bulb Temperature Rise | No. 20-D

# Gas Industry Accepts Boiler and Furnace Code

## A. G. A. Testing Laboratory Busy Rating Gas-Heating Equipment on Comprehensive Performance and Construction Requirements Recently Adopted

*By Eugene D. Milener*

Chairman, Sub-committee on A. G. A. Approval Requirements for Central House-Heating Appliances.

A PROGRESSIVE step taken by an important branch of the heating industry to insure satisfactory performance, substantial and durable construction, and safe operation of gas-fired boilers and furnaces has been initiated and sponsored by the American Gas Association. The rapid growth of house heating with manufactured gas, supplementing the extensive use of natural gas for that purpose, presented the need for insuring a sane basis for future growth, and avoiding the many pitfalls that come when no set of generally accepted standards exists. Fortunately there exists a strong central organization in the gas industry, the American Gas Association, which is composed of practically every gas company in the United States and Canada, the manufacturers of gas boilers and furnaces, and their distributors.

Early in 1925, the association established a testing laboratory in Cleveland, O., the purpose of which, among other things, is to run extensive tests on all types of gas-burning appliances. Coincident with the establishment of the laboratory, a movement was started and subscribed to by the membership of the association to sell and recommend only gas appliances showing the Blue Star seal which certifies that the gas appliance so designated has passed every requirement of the laboratory for safety and performance.

The requirements for gas boilers, warm-air furnaces and floor furnaces were prepared by a committee of thirteen engineers. These men have had wide experience in the design, installation and operation of automatic heating-plants, and brought to their work the viewpoints of the most progressive gas companies and equipment manufacturers in the country. The group is known as the sub-committee on A. G. A. Approval Requirements for Central House Heating Appliances, and consists of the following personnel:

J. B. Allington, Rochester, N. Y.; C. B. Babcock, San Francisco; F. M. Banks, Los Angeles; C. L. Bryant, Cleveland; T. M. Foulke, Denver; E. L. Hall, Portland, Ore.; E. L. Payne, Beverly Hills, Calif.; A. A. Pihlman, New -York; Wm. E. Stark, Cleveland; H. D. Valentine, Poughkeepsie, N. Y.; H. Leigh Whitelaw, New York; Eugene D. Milener, Baltimore, Md., Chairman.

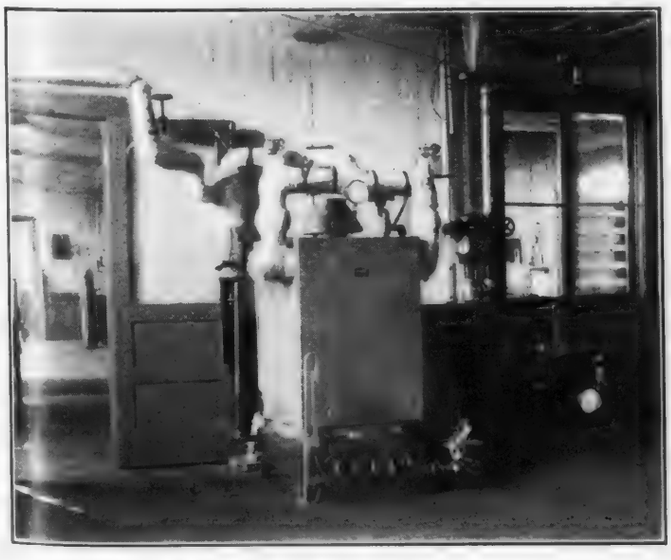
The committee has carried on two years of intensive work and has secured the adoption, by the American Gas Association, of a code of approval requirements to which, it is expected, all gas boilers and furnaces will shortly comply. In this codification, sight was not lost of the necessity of providing every opportunity for manufacturers to improve or better central house-heating gas appliances and to embody individuality in their construction.

It was the constant aim of the committee not to retard progress that in any way would effect economy, time, convenience, safety or cost to the user. It might be supposed that gas boilers and furnaces constructed in accordance with certain requirements would be essentially the same, regardless of the manufacturer—the term requirement being easily capable of an interpretation to convey this impression. However, requirements may be of widely different character, and as given in the code they are, for a large part, in the nature of laboratory performance requirements, with certain constructional requirements that do not preclude the embodiment of ingenuity of design and improvement.

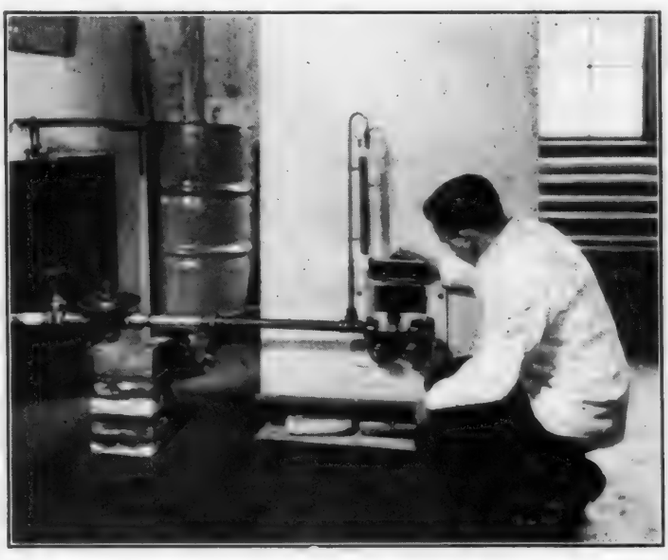
Provision has been made to amend the code to keep abreast of changes as the art of gas heating progresses.

There are two separate codes, one for boilers and the other for furnaces. Each consists of two parts—construction requirements and performance requirements.

The construction requirements for boilers contain all paragraphs of the A. S. M. E. Low-Pressure Heating-Boiler



Gas-Boiler Set Up in A. G. A. Laboratory for Rating Determination



Getting the Capacity Rating of a Gas-Fired Furnace

Code that can apply to boilers designed to burn a gaseous fuel, and, in addition, such requirements as to burners, pilots, gas and steam-regulating devices as the most advanced engineering thought dictates as necessary. The need of sensible construction requirements for gas boilers is seen when it is realized that the gas companies in practically every city have undertaken, to a certain degree, to furnish for service gas-heating plants, and it is imperative that this servicing be made as simple as possible. To this end simplicity of design and accessibility of parts have been stressed.

Probably the most interesting and important parts of the gas-boiler code are the performance requirements. Under this section, is the method of rating gas boilers. In view of the difficulty that has been experienced in codifying the rating of boilers burning solid and liquid fuels, it is refreshing to see a gas-boiler rating code spontaneously adopted and used by manufacturers, their agents and the great industry supplying the fuel. The American Gas Association rating is in terms of square feet of radiation and *is an exact measurement of the capacity of a gas boiler to produce heat.* The output of a gas boiler is the same hour after hour; and is the same with all gases. Its capacity is not affected by many factors that influence the selection of a coal boiler such as height of chimney, quality of fuel, frequency of firing, condition of fuel, bed, etc.

The American Gas Association steam rating is expressed as:

$$R = \frac{\text{Equiv. evap. in lbs. per hr.} \times 971.7}{240}$$

and the hot-water rating is given by:

$$R = \frac{\text{Lbs. water heated} \times \text{av. temp. rise}}{150}$$

With all gas boilers rated in this manner, everyone figuring on gas heating-jobs knows precisely what the output of each boiler is, regardless of make, and a degree of uncertainty that has always existed in selecting heating equipment will have been removed.

All boilers must show their rating without a flue connection, although a flue connection is always used when boilers are installed for heating buildings. This introduces a decided factor of safety. An additional factor of safety is assured by a provision that gas boilers shall produce no carbon monoxide when burning at full capacity and not connected to a flue. Very stringent provisions against flames flashing back are provided.

A feature that is perhaps unique is the provision that all boilers must bear a permanent name-plate on which shall appear the manufacturer's gas input-rating in B.T.U. per hour. With this information on each boiler, and a gas meter connected on each job, it is evident that heating equipment at last can be adjusted in a scientific manner, to suit the exact needs of the building.

Boilers and furnaces now are being tested at the laboratory, and the initial list of approved units is nearing completion. In meeting this code and displaying the Blue Star, the manufacturers are showing that they have met a very definite standard in design and performance, a standard written in black and white, applied impartially to all equipment.

## American Gas Association and Natural Gas Association Merge

Two important associations representing the natural and the manufactured gas industries have recently united under the joint name of the American Gas Association. In speaking of the combination, A. B. Macbeth, president of the American Gas Association, says, "Consolidated membership will consist of 650 operating companies, 450 manufacturer companies and 5400 individuals." A total annual output of natural and manufactured gas, it is estimated, approximates one trillion and a half cubic feet. It is also mentioned that some 14 million customers consume this amount. In joining together, these two organizations plan to use the national testing laboratory at Cleveland as their common research plant. The Natural Gas Association of America was organized in 1906, while the American Gas Association was incorporated in 1919 as the successor of the National Commercial Gas Association and the American Gas Institute.

## A.G.A. Industrial Gas Course

Application blanks for the third course, offered to industrial-gas salesmen by the Industrial Gas Section of the American Gas Association, are now available at the New York office of that organization, 420 Lexington Avenue. It is expected that about 200 will register. This course will extend from September 19 to October 1. All sessions will be held in the auditorium of the Consolidated Gas Co., New York.

Among the interesting lectures that will be given is one on "Industrial Heating Requirements," by J. A. Doyle, vice-president, W. S. Rockwell Company; another, "Gas in Relation to Competitive Fuels," by W. M. Hepburn, vice-president, Surface Combustion Company, and one on "Industrial Plant Surveys," by H. W. Hayward, director of the research department of Combustion Utilities Corporation.

## Is Gas a Legitimate Fuel?

Gas interests of the country, led by the American Gas Association, are embarking in a campaign to establish a new conception in regard to the position of coal in the scheme of things. Coal always has been considered a fuel. The gas interests would have this essential, and widely distributed source of energy, regarded as a raw material, from the social, scientific and industrial points of view. This thesis is advanced in the last annual report of the American Gas Association.

Believing that time will prove this theory, the report emphasizes the facts that gas plants can be located throughout the country where coal is easily available, and that a network of high-pressure gas mains can distribute gas over long distances. Two gas mains from Ohio to West Virginia, 300 miles long, have been in service for a sufficient length of time to demonstrate the feasibility of long-distance gas transmission at high-pressure and efficiency. Another natural-gas line, now under way, will be 450 miles long, and will carry gas at 450 lbs. pressure.

Gradual exhaustion of the natural-gas supply is a stimulus, according to the report, to the development of huge plants extracting gas from coal and leaving valuable by-products. Research is being undertaken by the American Gas Association Laboratory to determine the most economic combination of manufactured and natural gases.

## Gas Companies Must Make Service Calls

Gas service is becoming a more and more important factor in the lives of citizens every year, according to Oscar H. Fogg, vice-president of the Consolidated Gas Company of New York, and vice-president of the American Gas Association.

"During 1926 the New York company, and its affiliated companies, responded to 2,707,416 calls for special service to customers," says Mr. Fogg. "This is an average of more than 309 calls an hour every day and night of the year, including holidays and Sundays.

"A small army of specially trained men must be kept to provide the customer with service when he demands it. The increasing use of gas, for cooking, refrigeration, incineration, and house heating, has changed completely the complexion of the gas business."

The above figure of nearly 3,000,000 service calls looks tremendous, until it is realized that the Consolidated Gas Company and its affiliated organizations have 1,200,000 customers. Thus service calls have averaged about 2½ calls per customer per year.

## Death

F. A. RAMLER, president of The American Temperature Indicating Co., Toledo, O., and also The American Warming and Ventilating Company, passed away July 15. Mr. Ramler was connected with these companies for the past 14 years.

# Correspondence

*Conducted by T. W. Reynolds*

## How Boiler Connections Should Be Made

EDITOR HEATING AND VENTILATING MAGAZINE:

Herewith is a rough sketch of boiler connections. Do you think a tee looking down between the 6 in. x 4 in. tees should be installed, with but one equalizer at a header end, or perhaps you can suggest a better layout?

There are also a number of radiators on the wall, 3 ft. to 4 ft. above the boiler water-line. Should a check valve be used on the return?

LAWRENCE WADE.

Passaic, N. J.

Unless the 6-in. x 5-in. x 3-in. tees are made eccentric there is no way for the water to drain out of the bottom of the 6-in. header through drips or equalizers which are of smaller size. In the case in question the drips are only of 2-in. size, hence for better drainage, as well as, perhaps, for slightly better equalization than that shown, it would be better to have a full size tee, as suggested, midway of the header, looking down. However, it is always better to eliminate all drips from the equalizer, taking the latter from the nearest point to the boiler outlet, so as to eliminate length of travel as well as fittings, as these things tend to cause a pressure drop and thus prevent true boiler pressure from acting through the equalizer on the return. The accompanying sketch (Fig. 2) shows how the connections properly should be made.

A check valve is necessary on the return in order to prevent water from leaving the boiler, more especially should the return be wet or below the water-line of the boiler and, therefore, more liable to breakage, but, if arranged

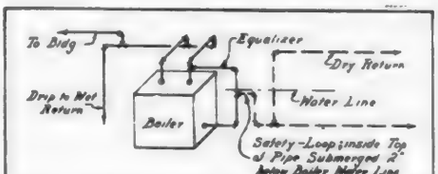



**Fig. 2. A Good Arrangement for Equalization at Boilers**

as a so-called safety loop, as sketched, the check valve will be unnecessary and a far better arrangement will be secured.

On a two-pipe gravity system of steam heating, check valves are desirable on the return end of radiators (especially where a reversed return is not used) in order to prevent steam which may enter the return from a radiator from backing up through a return runout into some other radiator. Steam traveling by such a route might reach and close the air valve of the last-mentioned radiator before all air has been expelled from this radiator.

A distance above the boiler water-line of from 18 to 30 in., according to the conditions, ordinarily is required to prevent return water from entering steam mains or radiators.

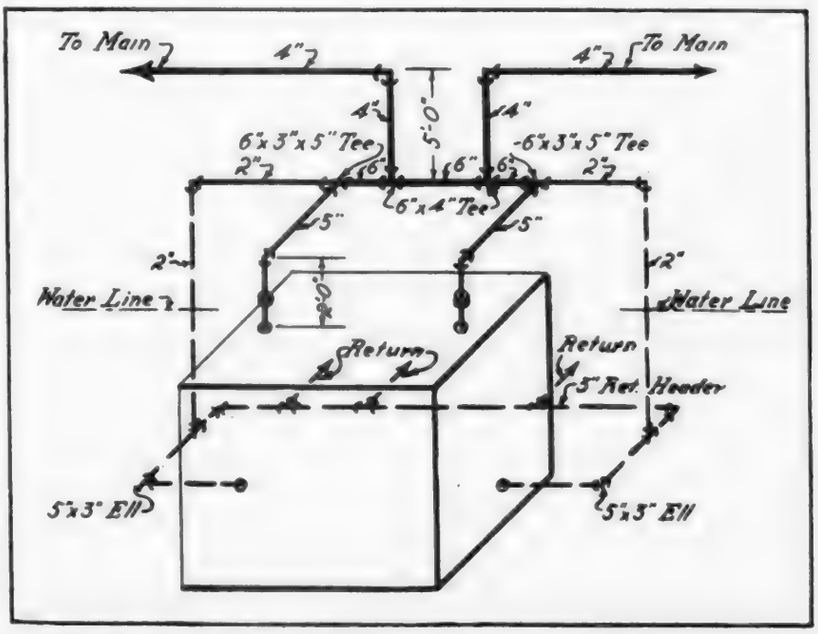



**Fig. 1. Sketch of Boiler Connections as Submitted by Correspondent**

## One-Pipe Versus Vapor for Oil or Gas-Fired Heating Systems

EDITOR HEATING AND VENTILATING MAGAZINE:

Which is better on an oil or gas-fired installation, a one-pipe gravity or a vapor system? Also please advise the best location for the thermostat.

New York. T. A. R.

One-pipe systems often are used with oil or gas-fired boilers, possibly because they reduce the higher total cost of boiler, burner and system. Furthermore, it is claimed by some that the advantages of a vapor system are lost when an oil or gas burner is installed, due to the contention that the boiler stops generating steam as soon as the oil burner cuts out, or, as held by others, that in any event the water in the boiler would be that much cooler by continuing to heat the radiation after the burner is off and that this water would have to be raised in temperature once more when the burner is on again.

In reply to the first-mentioned claim it may be said that the water in the boiler will continue to generate steam for some time after the burner cuts out, because with each increase in vacuum formed within the radiation there is a further liberation of steam from the water due to the lower pressure. An examination of the pressures and corresponding temperatures of any steam table will prove this point.

It is interesting to note, relative to gravity versus vapor systems, that whereas 3 tons of coal per 100 sq. ft. of radiating surface per heating season is the usual rule of thumb for estimating the seasonal requirements of coal for gravity systems, only 2 to 2¼ tons have been found necessary with a good vapor system. A hotter fire has to be carried in a gravity system in order to get the necessary pressure and circulate steam, meanwhile the stack loss is constantly going on. Furthermore, in gravity systems, energy is required for compressing the air in order to drive it out through the pin holes of the radiator air valves.

If the thermostat is located in the hall of the house it is bound to be affected by the heat from hall or vestibule radiators which are usually sized rather large. If these radiators are valved off, the thermostat probably will not shut off the heat as quickly as it should because of cold drafts of air entering from the vestibule. On the other hand, with the radiators turned on, the thermostat

doubtless will be affected to the extent that it shuts off before the house has been heated at other points. Furthermore, locating the thermostat upstairs in order to heat the upper rooms which are sometimes slower to heat up will only result in overheating of the lower floor.

Of course, a lower or higher adjustment of the thermostat to suit each case possibly could be made; however, it is desirable that the problem be solved in a simpler and less complicated way, hence the thermostat should be located on an inside wall of the living room, well away from any radiators or other source of heat. But it should be remembered that wherever heating is controlled according to the temperature existing at one point only, as by a single thermostat in residence heating, the heating will seldom be entirely satisfactory in all rooms of the house. For example, overheating in the vicinity of the thermostat usually will be required in order to heat the balance of the room.

On account of the tendency for automatic control to cut out the oil burner before distant radiation is freed of air, one should make use of the reversed return in designing a two-pipe system. This will insure practically simultaneous heating of all radiators, as well as their continued heating at an equal rate, irrespective of their distance from the boiler.

## Greasy Core Sand in Radiators

EDITOR HEATING AND VENTILATING MAGAZINE:

THE HEATING AND VENTILATING MAGAZINE, for February, contained an article by a contractor who had water trouble in his boiler presumably due to a greasy boiler. Another contractor agreed with this diagnosis, but contended that the grease was due to sand in the radiators.

From my experience in foundry work I am inclined to agree with him. Even to a layman it must be obvious that ½ in. of molten iron will burn up the core sand of a boiler casting to a greater extent than ⅛ or ¼ in. of iron in radiator castings; in fact, it burns up to absolute dust, easily rapped out.

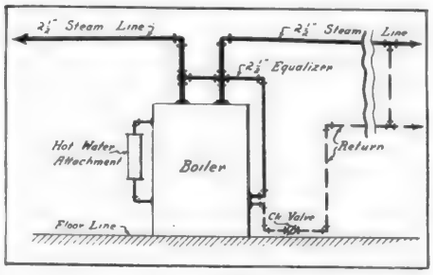
Twenty years ago cores were made of sand mixed with molasses and flour; to-day in order to eliminate rods and skilled labor the sand is mixed with compounds which make the core nearly as hard as the casting and very difficult to knock out. To what extent they are cleaned depends upon the integrity of the manufacturer and his workmen.

My trouble, for which I ask your advice, seems different from the correspondent whose boiler loses water as the fire increases. The boiler has two 2½ in. risers and a wet return with swing check valve. As the fire increases the water goes up to the top of the gauge and apparently into the steam line. The next morning when the fire is low, the glass is empty.

The system is single vapor with vacuum air valves. Do you suppose a vacuum exists which sucks out the water? Have added an equalizer and have cleaned out the boiler three times in six months with vinegar and advertised compounds, in addition to blowing it out through the safety valve. The system is new and the trouble persists. Would appreciate any suggestion you might make.

Brooklyn, N. Y. J. F. B.

It is not a good practice to use compounds which make a hard core because any saving that may result from this method is soon offset by troubles which




**Sketch of Boiler Which Appears to Lose Water**

develop in the process of manufacture. Such a method, therefore, would rarely be used, if at all.

Speaking from knowledge of the method used by one of the largest manufacturers of radiators, it may be said that the materials comprising their cores are sand, rosin and linseed oil. The linseed oil has a low flash point, the rosin a low fusing point, hence these elements quickly burn up, leaving the sand, which disintegrates.

From raw castings to finished product, the radiator is roughly handled and struck many hard blows in rapid succession with a hammer in order to trim off the projections of metal which adhere, as well as for many other reasons. In addition to this it is placed on a traveling mechanism which repeatedly strikes the radiator in order to eliminate the sand.

Boiler castings are more apt to be 7/16 or ⅜ in. thick than they are ½ in., but, irrespective of the precise thickness of the casting, it should be borne in mind that the greater destructive heat effect tending to disintegrate the core due to the additional thickness of boiler metal is more than offset by the greater thickness of core used, one that is many times as thick as that of a radiator casting. If anything, the radiator core should disintegrate the more rapidly, especially in the newer types of radiation where there is but a small tube which has only a small core surrounded by a proportionately larger amount of metal, which metal is as thick as in the older types of radiation.

Now as to the trouble of which the correspondent complains, it will be seen that the sketch is not complete enough to permit of more than a general analysis, though judging from the stated conditions, it would seem that the packing nuts on the valves of the water column need tightening in order to prevent inleakage of air when the system is under vacuum.

During such times the atmosphere is at a higher pressure than that within the system, hence the pressure of the atmosphere entering at the leaks forces the water up through the gauge glass; the boiler will then appear to be empty, although, if the glass is watched closely, minute air bubbles may be seen ascending.

This condition can easily be proved by pulling open the safety valve to see if the air rushes in. If it does, continue to hold the valve open until the vacuum is broken or the pressure within and without the boiler equalized. The water-line should then be detected at the normal point.

It also should be borne in mind that when the fire is banked the steam in the radiators condenses and causes a vacuum to exist which would cause the water to leave the boiler by way of the return if it were not for the check valve, though if the check valve has become lodged in the open position the trouble as described could readily come about. If there is a slow fire in the boiler, the radiators may be under a partial vacuum, tending to hold up water back of the check valve, or there may be a leak in the return if the return is below the floor, instead of as shown.

There are well-known liquids and compounds which will clean out a boiler and which have often cured just such troubles as described, even though it was strongly felt that the trouble was elsewhere. Several cleanings are required in new systems. This one appears to have a boiler that is priming or throwing over water.

## Why the Far Radiator Does Not Warm Up on a Thermostatically-Controlled System

EDITOR HEATING AND VENTILATING MAGAZINE:

I have a radiator in a guest bedroom remote from the boiler which does not heat up in mild weather, but which, strange to say, does not heat up and warm the room satisfactorily in severe weather. This seems very peculiar to me. It certainly has aroused my curiosity, at least to the extent that I am writing for your idea on the matter.

I am quite certain that the amount of radiation is sufficient and that the size, slope, venting and drainage of the piping is correct, as these points have not been overlooked by a number of investigators. The heating system is one-pipe with an oil burner, which, of course, is thermostatically controlled. The thermostat is located in the hall. Heating of rooms with the given exception, is quite satisfactory.

New York. J. A. V.

When the thermostat operates automatically, so as to shut down the oil burner, pressure begins to drop. This

lack of pressure will be noticeable first at the place where pressure is most required, which is evidently at this radiator, because of its greater distance from the boiler. As a consequence, the radiator cools off more quickly than the other radiators of the heating system, while the air valve draws in more air than is taken in elsewhere. This air has to be expelled when pressure is raised again. As this takes some time and more time than at other points, the house heats to the desired temperature at these other points more quickly, so that the thermostat shuts off before the air is fully discharged from the radiator in mind, and, as a consequence, the radiator never is as thoroughly heated throughout as it might be otherwise. This occurs a number of times, each time some air drawn back in, but not as much returning, depending upon the lapse of time,* until later in the day the radiator may become fully heated.

The radiator may be large enough to heat the room, but there is a time element, it heats up too slowly and cools off too quickly, more so than any other radiator, hence it is not entirely hot long enough to take care of the continuous heat loss from the room. However, if, early in the day, pressure were raised at the expense of temporarily overheating the rest of the house, so that the air were driven out of this radiator in the beginning, it would not work so poorly the rest of the day. This could be done whenever the room is occupied by guests.

In any event, it is better to set the thermostat at a higher point the first thing in the morning, so as fully to vent all of the radiators before pressure is allowed to drop, thus insuring circulation to the more sluggish radiators; then, when the pressure is allowed to drop, it will take more time for air to re-enter the radiators, the radiators giving up heat the meanwhile, for the reason that they cool off more slowly, once the air is fully expelled.

The rooms also will cool off more slowly, causing the burner to be off and on less often, which is a good thing, in order to prevent the constant repetition of air being expelled, then drawn in again. Furthermore, the less often that the burner cuts off and on, the less the interval of time that heat is wasted out of the stack, which accounts for some of the savings made by a good vapor system. Each time energy or pressure is needed to expel the air before heating begins; this takes time, and during this time the heat loss through the stack keeps up.

In colder weather, the burner will not be off and on so much, so that there will be more time, when pressure is raised, for the radiator in question to rid itself of air and less chance of air being drawn in again. This accounts for the unsatisfactory heating of the radiator in mild weather and its quite satisfactory heating in cold weather, even though the amount of heating done is greater in the cold periods.

A possible remedy for the difficulty with this radiator, one that would be simple and inexpensive, is the substitution of a large quick-vent valve (such as is used at the end of mains) in place of the present ordinary radiator air valve which requires much more pressure when venting than some of the quick-vent valves.

Because of the reasons outlined it is desirable that vapor systems be used in connection with all forms of automatically-controlled heating systems, such as those equipped with oil or gas-fired boilers. One and two-pipe ordinary gravity systems require too much pressure—they let the air re-enter the system too quickly, have no ability to circulate steam at low pressure to the radiators and, because of the pressure required, are not sufficiently responsive.

*Air will not return as fast, because radiators cool off more slowly than they heat up.

## Dry Versus Wet Returns

EDITOR HEATING AND VENTILATING MAGAZINE:

Will you please advise which is the best method to use with one-pipe steam heating systems for one-family houses, a dry return or a wet return?

I am the owner of a one-family house having a wet return, also a two-family house with dry returns. One system with dry returns gives good results, but in the case of the other dry return system the water disappears from the boiler when pressure is raised. Possibly the return should be vented or an equalizer should be used.

On all speculation jobs which I have seen the fitter installs wet returns which in several cases give poor results. These systems are installed without checks or vents. Are dry returns more satisfactory for this reason, because getting down to the theory of steam operation in this type of heating system I find that there is friction due to fittings, valves and pipes, which causes a pressure loss between the boiler and the end of the steam main?

As the steam travels away from the boiler the pressure becomes less than at the boiler and the return main connects at this lowest point of pressure. It is known that water pressure is the same at the far point as at the boiler, but, due to the fact that the steam pressure is lower at this point than at the boiler, the water in the return at the end, where it is connected with the steam main, will rise to a level or height above the water-line so as to form a static head, due, of course, to the pressure difference. This may cause flooding of the steam main at the end.

New York. HENRY HUNTER.

Wet returns are slightly cheaper because they are smaller in size, due to the fact that they convey only water; furthermore, they are seldom covered because they are at a lower temperature than dry returns which contain both steam and water, nor do they have to be hung from the ceiling as in the case of dry returns. Such returns also are of advantage wherever net headroom is too limited to allow for a dry return, or where basement radiators are installed which may be connected into this wet return.

They have some minor possible disadvantages, being more liable to freezing and breakage, possibly emptying a boiler not properly safeguarded against such a liability; they are more prone to stoppage because of sediment, and the pipe covering, if any, is more likely to be destroyed than if the pipe is located near the ceiling.

In operation there is no difference between the two. Of course, a dry return loses a bit more of heat, but as this serves to warm the floor above, the heat is not lost.

Where the distance of the air valve above the water-line is not all that it should be (18 to 30 in. according to the conditions), it is better to vent and drop wet as soon as possible and then return to the boiler than it is to vent and drop wet at the boiler, as the latter method would cut down the height of the air valve above boiler water-line. From this it will be seen that water would be more apt to rise in the return and interfere with the proper working of the air valve when located at the boiler than it would if the air valve were located at the far point from the boiler, a point which is somewhat higher.

The two methods can be put on an equal basis, however, simply by venting the main at its end where it drops to connect to the dry return. In this case the water in the dry return would flow back to the boiler, even though there is air in the return, and any slight amount of air displaced by the water would not have to be forced out through the radiator air valves but would be vented back through the air valve at the end of the steam main. However, this practice of placing the air valve at the far end, away from the boiler, is not recommended for dry returns where there is plenty of headroom available.

The trouble described by the correspondent in the case of the one dry return may be caused and doubtless is by priming and foaming of unclean water at the boiler. Of course, in all cases of returns, whether wet or dry, the end of the mains where they drop wet should be vented and the boiler should be properly equalized.

It is considered good practice to use vents, otherwise more steam pressure must be raised in order to gradually force the air in the steam mains out through the pin holes of air valves on the radiators, thus making the ends of the steam mains and the far radiators rather slow in warming up. On the other hand, vents are of no use after a year or so of use unless given the proper amount of attention, a thing which always is not done.

There is no appreciable drop in steam pressure due to the longer run as with the steam in a dry return, because there is no flow of steam in the return other than that as occasioned by steam condensing in the pipe.

# Solving the Oil-Burner Service Problem

## Various Practices Work Toward the Same End, But Uniform Methods Are Not Yet Established

THERE has been much discussion on the subject of oil-burner service requirements and problems, but the solution is yet a long way off. The executive head of one of the largest and most conservative organizations declares that the service department is of greater relative importance than the sales department. "An inefficient service department," he says, "can wreck the best sales organization ever brought together." On the other hand, an efficient service, closely co-ordinated with the sales department, will be a tremendous factor in increasing sales through the medium of the satisfied customer.

First of all, the sale must have been made on a sound foundation—the complete fitness of the heating system for the building and the adaptability of the burner to the boiler or furnace. The former consideration involves an ability to visualize the job as a heating engineer, rather than as a merchandiser of oil burners. It is essentially a problem in the application of a heating system to a building, and no one but a qualified person should attempt to pass judgment on the correctness of the application.

If the oil-burner sales organization is so small that the services of a competent heating engineer cannot be justified, it is essential that some member, with the necessary engineering feeling, "bone up" on the subject until he has a reasonable appreciation of the elements involved. If this phase is allowed to remain outside of the picture, the manufacturer, through his sales tentacles, is faced with a dissatisfied customer, although the oil burner, as a unit, may have been above reproach. There will be "service call" after "service call," although no stigma can attach to the burner.

### METHODS OF HANDLING SERVICE VARY

There are any number of methods of handling service; some have worked well in one section but not in another. One company, in a section where there was relatively a large number of burners, employed service men, who furnished their own cars, paying them a flat sum of $1.50 per call. Each man was given an area containing enough burners to keep him busy. Reports of each call were made to headquarters, and as each call involved a check-up of the essentials of the burner, the sales office was kept in pretty close touch with its customers.

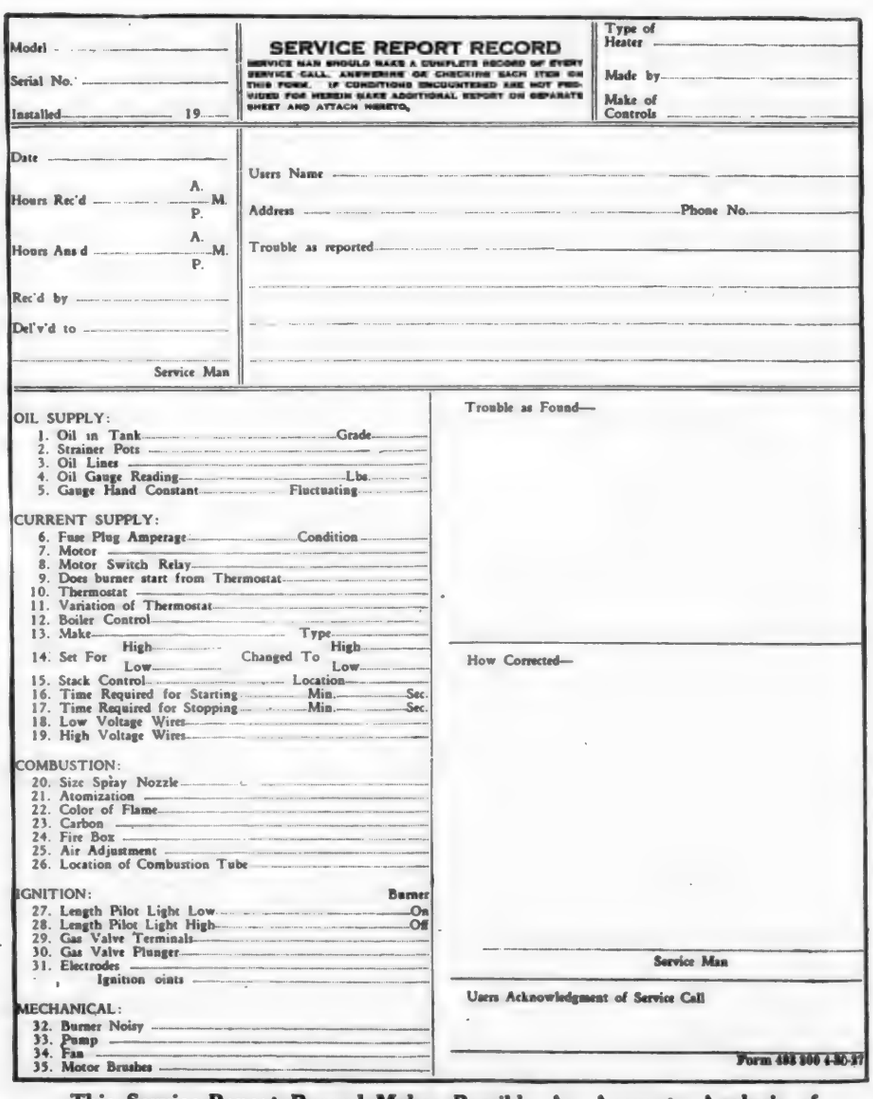
To insure careful attention on the part of the service men, they were required to service, without compensation, if a call was made within two weeks after a service, unless it was obvious that the call was a "foolish" one, or not due to carelessness on the part of the service man. In such cases the customer was not again charged.

In another territory, the agents of this company pay a weekly salary to service men and either furnish them with cars or make an allowance for a car owned by the employee. Each man is made responsible for all burners in a given territory, and is paid a bonus if no calls are received from his territory on any installation within two weeks after the burner has been serviced. This bonus is approximately 10% of the weekly wage.

Yet other dealers representing the same company maintain central service stations, sending the service men out in rotation as calls are received. This probably is not as satisfactory as the first two plans. The service may properly be handled, but, in the former case, the service man becomes acquainted with the owners in his territory and frequently, through being of the proper caliber and showing real interest in his work, he secures "tips" or leads that result in sales. By paying a small commission in such cases, the service man is stimulated to render the best possible service.

It is customary to post in the furnace room the telephone number through which service can be secured, and this telephone should be available every day between 7:00 o'clock in the morning and 10:00 o'clock at night, with extension to midnight in severe weather.

Although it may appear to be a non-essential, all service men should be forced to be neat in their appearance for the moral effect on both the man



SERVICE REPORT RECORD

SERVICE MAN SHOULD MAKE A COMPLETE RECORD OF EVERY SERVICE CALL. ANSWERING OR CHECKING EACH ITEM ON THIS FORM. IF CONDITIONS ENCOUNTERED ARE NOT PROVIDED FOR HEREIN MAKE ADDITIONAL REPORT ON SEPARATE SHEET AND ATTACH HERETO.

Model
Serial No.
Installed 19
Type of Heater
Made by
Make of Controls

Date
Hours Rec'd A. M. P. M.
Hours Ans'd A. M. P. M.
Rec'd by
Del'v'd to
Service Man

Users Name
Address Phone No.
Trouble as reported

OIL SUPPLY:
1. Oil in Tank Grade
2. Strainer Pots
3. Oil Lines
4. Oil Gauge Reading Lbs.
5. Gauge Hand Constant Fluctuating

CURRENT SUPPLY:
6. Fuse Plug Amperage Condition
7. Motor
8. Motor Switch Relay
9. Does burner start from Thermostat
10. Thermostat
11. Variation of Thermostat
12. Boiler Control
13. Make Type
14. Set For High Low Changed To High Low
15. Stack Control Location
16. Time Required for Starting Min. Sec.
17. Time Required for Stopping Min. Sec.
18. Low Voltage Wires
19. High Voltage Wires

COMBUSTION:
20. Size Spray Nozzle
21. Atomization
22. Color of Flame
23. Carbon
24. Fire Box
25. Air Adjustment
26. Location of Combustion Tube

IGNITION: Burner
27. Length Pilot Light Low On
28. Length Pilot Light High Off
29. Gas Valve Terminals
30. Gas Valve Plunger
31. Electrodes
Ignition oints

MECHANICAL:
32. Burner Noisy
33. Pump
34. Fan
35. Motor Brushes

Trouble as Found—

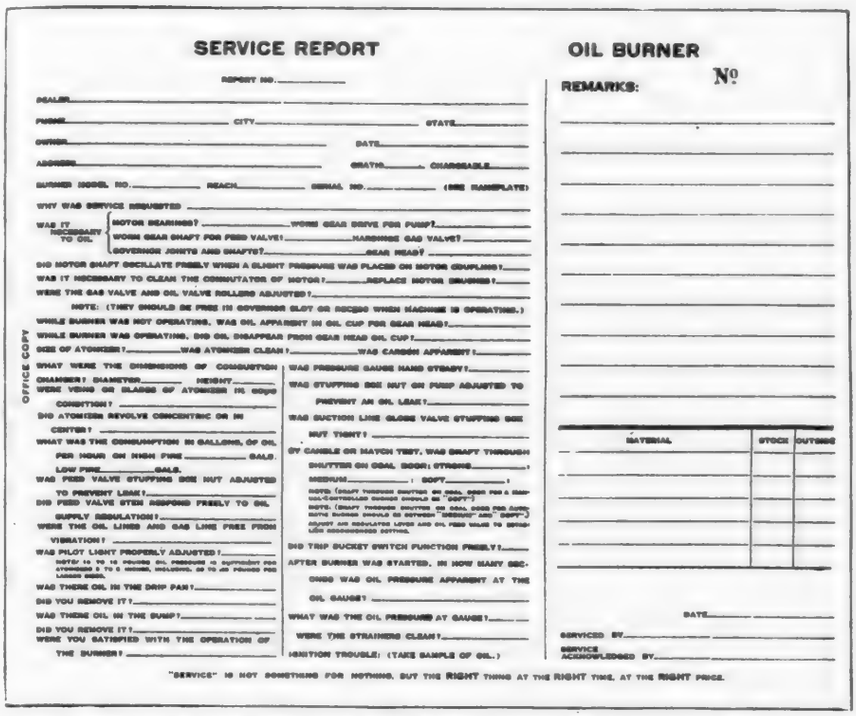
How Corrected—

Service Man

Users Acknowledgment of Service Call

Form 483 100 4-30-27

**This Service-Report Record Makes Possible An Accurate Analysis of Oil-Burner Troubles**



SERVICE REPORT

OIL BURNER

REPORT NO. _____

DEALER _____

PHONE _____ CITY _____ STATE _____

OWNER _____ DATE _____

ADDRESS _____ GRATIS _____ CHARGEABLE _____

BURNER MODEL NO. _____ REACH _____ SERIAL NO. _____ (SEE NAMEPLATE)

WHY WAS SERVICE REQUESTED _____

WAS IT NECESSARY TO OIL: MOTOR BEARINGS? _____ WORM GEAR DRIVE FOR PUMP? _____ WORM GEAR SHAFT FOR FEED VALVE? _____ HARDINGE GAS VALVE? _____ GOVERNOR JOINTS AND SHAFTS? _____ GEAR HEAD? _____

DID MOTOR SHAFT OSCILLATE FREELY WHEN A SLIGHT PRESSURE WAS PLACED ON MOTOR COUPLING? _____

WAS IT NECESSARY TO CLEAN THE COMMUTATOR OF MOTOR? _____ REPLACE MOTOR BRUSHES? _____

WERE THE GAS VALVE AND OIL VALVE ROLLERS ADJUSTED? _____

NOTE: (THEY SHOULD BE FREE IN GOVERNOR SLOT OR RECESS WHEN MACHINE IS OPERATING.)

WHILE BURNER WAS NOT OPERATING, WAS OIL APPARENT IN OIL CUP FOR GEAR HEAD? _____

WHILE BURNER WAS OPERATING, DID OIL DISAPPEAR FROM GEAR HEAD OIL CUP? _____

SIZE OF ATOMIZER? _____ WAS ATOMIZER CLEAN? _____ WAS CARBON APPARENT? _____

WHAT WERE THE DIMENSIONS OF COMBUSTION CHAMBER? DIAMETER _____ HEIGHT _____

WERE VANES OR BLADES OF ATOMIZER IN GOOD CONDITION? _____

DID ATOMIZER REVOLVE CONCENTRIC OR IN CENTER? _____

WHAT WAS THE CONSUMPTION IN GALLONS, OF OIL, PER HOUR ON HIGH FIRE _____ GALS. LOW FIRE _____ GALS.

WAS FEED VALVE STUFFING BOX NUT ADJUSTED TO PREVENT LEAK? _____

DID FEED VALVE STEM RESPOND FREELY TO OIL SUPPLY REGULATION? _____

WERE THE OIL LINES AND GAS LINE FREE FROM VIBRATION? _____

WAS PILOT LIGHT PROPERLY ADJUSTED? _____

NOTE: 10 TO 12 POUNDS OIL PRESSURE IS SUFFICIENT FOR ATOMIZERS 5 TO 6 INCHES, INCLUDING, UP TO 40 POUNDS FOR LARGER SIZES.

WAS THERE OIL IN THE DRIP PAN? _____

DID YOU REMOVE IT? _____

WAS THERE OIL IN THE SUMP? _____

DID YOU REMOVE IT? _____

WERE YOU SATISFIED WITH THE OPERATION OF THE BURNER? _____

WAS PRESSURE GAUGE HAND STEADY? _____

WAS STUFFING BOX NUT ON PUMP ADJUSTED TO PREVENT AN OIL LEAK? _____

WAS SUCTION LINE GLOBE VALVE STUFFING BOX NUT TIGHT? _____

BY CANDLE OR MATCH TEST, WAS DRAFT THROUGH SHUTTER ON COAL DOOR: STRONG _____ MEDIUM _____ ! SOFT _____ !

NOTE: (DRAFT THROUGH SHUTTER ON COAL DOOR FOR A GAS-OIL-CONTROLLED BURNER SHOULD BE "SOFT.")

NOTE: (DRAFT THROUGH SHUTTER ON COAL DOOR FOR AUTOMATIC BURNER SHOULD BE BETWEEN "MEDIUM" AND "SOFT.")

DRAFT AIR REGULATOR LEVER AND OIL FEED VALVE TO BE SET FOR RECOMMENDED SETTING.

DID TRIP BUCKEY SWITCH FUNCTION FREELY? _____

AFTER BURNER WAS STARTED, IN HOW MANY SECONDS WAS OIL PRESSURE APPARENT AT THE OIL GAUGE? _____

WHAT WAS THE OIL PRESSURE AT GAUGE? _____

WERE THE STRAINERS CLEAN? _____

IGNITION TROUBLE: (TAKE SAMPLE OF OIL.)

REMARKS: No

| MATERIAL | STOCK | OUTING |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

DATE _____

SERVICED BY _____

SERVICE ACKNOWLEDGED BY _____

OFFICE COPY

"SERVICE" IS NOT SOMETHING FOR NOTHING, BUT THE RIGHT THING AT THE RIGHT TIME, AT THE RIGHT PRICE.

**Only Through Use of Forms of This Kind Can the Manufacturer Properly Study the Operation of His Product**

and the customer. Sloppy men breed sloppy work and their appearance belies a high standard.

### SERVICE FOR OWNERS AWAY FROM HOME

One enterprising dealer makes a specialty of service where the home owner is away from home. He claims that it is just as foolish to expect an oil burner to function continuously without attention as it would be for the home owner to drive his car to the station, take a 30-day trip to Florida and expect the engine to be running upon his return. This dealer advises his customers to notify him in case of proposed absence and he arranges to have a service man call twice a day. This service, of course, is purely preventative.

The fundamental program of the institute was to disseminate information to the public. To do this an advertising agency was appointed to determine the magazines which were read by the class of public best qualified to buy oil burners. By advertising in the leading general magazines, it was estimated approximately seven million people would be reached each month.

An investigation was sponsored by the institute among architects and builders to find out what questions were asked about oil heating by professional and business men. Information received from this source led to circulating a series of bulletins containing facts and figures to architects, engineers, builders, city officials, oil-supply men and coal dealers.

A book, "Oil Heating—The Modern Miracle of Comfort," which is a guide for the selection of oil-heating equipment, has had a circulation of over 6,000 copies, which is deemed indicative of the interest on the part of the public in oil heating.

One of the interesting phases of the work accomplished has been the cooperation received from municipal authorities throughout the country in drafting ordinances to govern the installation of oil-heating equipment. Where ordinances are unnecessarily exacting, the expense of the installation to the buyer is increased. On the other hand, when the ordinance is lax or obsolete, it is possible that the installation of the oil-heating equipment will constitute a fire hazard. Civic authorities are making requests daily for information, advice or suggestions. A model ordinance is being published for circulation among state and municipal officials in the hope that it may be used as a basis in revising or formulating uniform regulations for oil-heating installation.

A more technical aspect of the institute's work is its research on fuel oil. American Society for Testing Materials, American Petroleum Institute and the Oil Heating Institute are co-operating in an attempt to fix definite, standard specifications and simplified trade names for various types of oil fuel on the market.

Many inquiries also come from editors of magazines and business papers, feature-article writers, advertising agencies, European and South American organizations.

The institute contemplates the preparation of a book giving the detailed steps to be taken by local dealers in the organization of local oil-heating associations. This will be prepared in collaboration with the American Oil Burner Association.

Another dealer, with over 800 installations within a 15-mile radius, reports that, with two men on duty by day and one at night (24-hour service is maintained), entirely satisfactory service has been maintained, without a single record of a customer being minus heat overnight except through the fault of not ordering oil.

This same organization has had approximately one-third of its customers go through the entire heating season without a call; another third average from one to ten calls per heating season. The recently-installed burners are charged with the greatest number of calls in many cases, the owners appearing to feel that they are lacking in interest if they do not take advantage of the free service and have a representative come in every three or four weeks.

The largest number of calls is reported from homes of men "who think they are mechanics and who try stunts with the burner." If the owner of the burner happens to be a real mechanic, he is practically never heard from. Many who are first-class customers during the free period are seldom heard from when they are charged from $1.50 to $2 per hour for service calls.

One manufacturer with several thousand burners in service, many of them through five winters, reports that all accumulated data from the dealers in the city with the best record show two calls on each burner, per heating season, and, at the prevailing charge of $1.50 per call, represents an average annual service cost, to all owners, of $3. In the city having the poorest report, the average was a trifle over six calls on each burner. At the prevailing rate, $2, this represents service cost of $12 per annum. The average for all returns showed four calls per season per burner, or a country-wide average of $8 annual service charge.

### OWNERS CHARGED FLAT RATE OR ON TIME BASIS

Another growing practice has been to allow the owners of burners to choose between paying for service at a designated charge per hour, or per visit, or to bill them a fixed fee for any service that may be rendered during the heating season. In the latter case, the burner is always visited in the spring, cleaned, started up and checked in its operation, then shut off and covered for the summer. Again, before the beginning of the heating season, the burner is inspected, started up and rechecked as to functioning. For such annual service, charges varying between $20 and $30 are made. In one large community, 75% of the owners of one popular burner desired this class of service.

Sixty per cent of service calls results from owners neglecting to keep burners clean, according to a dealer who is servicing nearly 200 machines, some sold three years ago. This dealer finds that 20% of his calls come from owners that

have "monkeyed" with their burners. He services all burners that have passed beyond the free period, either on the basis of a flat charge of $6 per month, or at the rate of $1.80 per hour. The former charge entitled the owners to three service calls per month, at each of which the burner is cleaned and checked. He reports his customers about evenly divided in their preference to these plans.

From the foregoing, it is evident that the matter of oil-burner service is not yet definitely settled, although, with so many plans working and so many keen minds attempting to find the universal panacea, and with the interchange of ideas that is becoming more possible each year, it is more than likely that another two years will see a definite answer that will fit most local conditions.

WHY NOT A SINGLE COMMUNITY SERVICE?

It has been suggested that, in communities where there are representatives of from six to ten different manufacturers, it would be advisable for them to pool their interests and provide a single service that, with greater efficiency and lower cost, could furnish a higher grade of service than would be possible if each had his own department. In such a case, expert electricians could be assured, and, as the controls on practically all of the burners are made by three or four manufacturers, these men would be well qualified to handle electrical troubles on all burners. Such a plan is worth trying, the main essential being absolute fairness in dealing with the different makes of burners.

A suggestion supplementary to the above is that such service be rendered by the company distributing oil for the burners in any community. This company owes its expansion to this increase in oil-burner installations in that town, and any burner that is taken out means just that much less business. Consequently, that company is probably as much interested in the satisfaction experienced by oil-burner purchasers as any other establishment, and regardless of the make of burner.

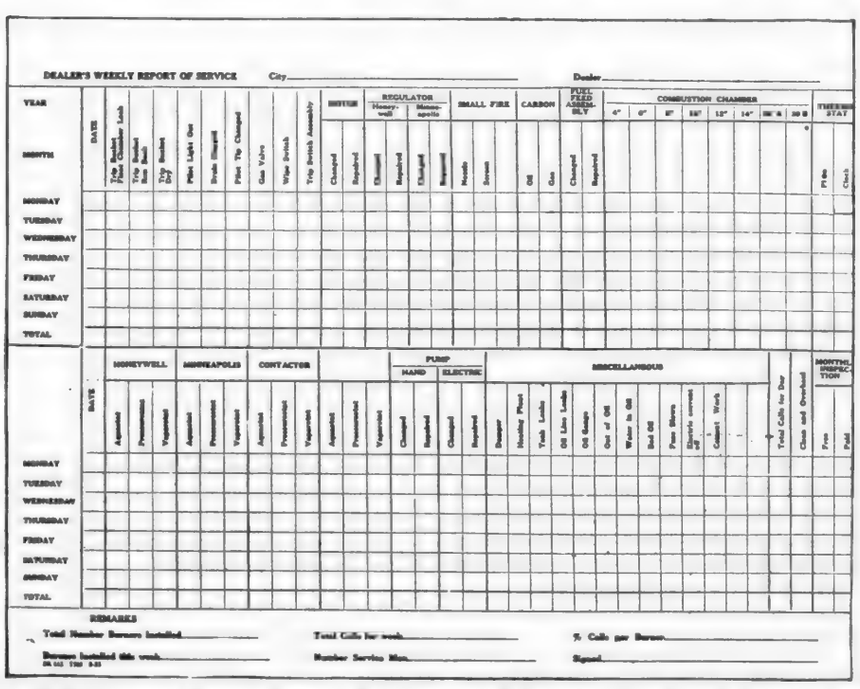
For this reason, the handling of the service by the oil company is logical and entirely feasible. A crew of three men, monthly, could make the rounds of all burners; one man could "stick" or otherwise check the amount of fuel in the tank, record it for the office record and clean the oil strainers. An electrical man could rapidly check over the electrical parts of the burner, while a burner man gave the burner the "once over." Thus would all of the elements of trouble be provided against by a single visit each month, requiring about fifteen minutes.

FORMS FOR RECORDING OIL-BURNER SERVICE

In the matter of handling, recording and analyzing service calls, some interesting pioneer work has been done. The forms shown represent the work of years on the part of service experts with three of the important manufacturers.

It must not be inferred that these forms indicate burners requiring many service calls; rather the opposite is true. The purpose and intent of such an elaborate form is to make possible the accurate classification and analysis of trouble (much of which properly may not be chargeable to the burner) before any undesirable condition becomes widespread.

The service manager of the manufacturer eagerly scans these reports as they come in—a duplicate should be sent to the factory in all cases, no matter how trivial they appear. If a thousand burners are in service and a hundred service-call reports come in during a given period, these may mean much, or nothing. If the causes, as marked, are about everything on the form, and perhaps unthought of things besides, there is little or nothing to worry about. But, let five, or ten, or a larger number out of the hundred calls, be for the same fault, and there isn't the slightest doubt that something definite is wrong and needs instant attention. Immediate action to correct this fault, in many cases, will save a great deal of money. Consequently the wise service-manager develops a service form containing provisions for recording every possible trouble, even if, in his own heart, he knows that it simply cannot happen.


DEALER'S WEEKLY REPORT OF SERVICE City Dealer

YEAR / MONTH — DATE

IGNITER: Changed, Repaired

REGULATOR: Honeywell (Changed, Repaired); Minneapolis (Changed, Repaired)

SMALL FIRE: Heads, Screws

CARBON: Oil, Gas

FUEL FEED ASSEMBLY: Changed, Repaired

COMBUSTION CHAMBER: 4", 6", 8", 10", 12", 14", 16" x 24", 20 x 30

THERMOSTAT: Fix No., Check

MONDAY / TUESDAY / WEDNESDAY / THURSDAY / FRIDAY / SATURDAY / SUNDAY / TOTAL

DATE

HONEYWELL: Adjusted, Pressuremeter, Vaporstat

MINNEAPOLIS: Adjusted, Pressuremeter, Vaporstat

CONTACTOR: Adjusted, Pressuremeter, Vaporstat

Adjusted, Pressuremeter, Vaporstat

PUMP: HAND (Changed, Repaired); ELECTRIC (Changed, Repaired)

MISCELLANEOUS: Burner, Humidity Pistol, Vents Leaks, Oil Line Leaks, Oil Gauge, Out of Oil, Water in Oil, Bad Oil, Fuse Blown, Ignitor current, Cabinet Work, Total Calls for Day, Clean and Overhaul

MONTHLY INSPECTION: Free, Paid

REMARKS

Total Number Burners Installed Total Calls for week % Calls per Burner

Burners Installed this week Number Service Men Signed

**A Well-Prepared Service Record Will Indicate If Service Calls Result From a Few Well-Defined Faults or From Many Undefinable Causes**

## Oil-Burner Research and Advertising Activities Correlated

The Oil Heating Institute, a non-commercial organization, is engaged in research and educational work on oil fuel, oil heating and the oil-heating industry. The institute was founded in April, 1927, by 27 manufacturers of oil-heating equipment—members of the American Oil Burner Association—who realized the necessity of collecting information about the oil-heating industry and the application of oil, and of having it properly correlated and distributed among architects, engineers, builders, city officials, and home and building owners.

## "Anthracite" Reports Interesting Examples of Service

The latest bulletin of Anthracite Coal Service, maintained by the anthracite coal operators to give free engineering advice to those seeking information on the economical use of anthracite coal for heat and power purposes, reports in its last issue on two cases where studies by its engineers resulted in greatly benefiting previous conditions. Both of these reports cover surveys made of high-pressure boilers, and for this reason they are not of direct interest to readers of THE HEATING AND VENTILATING MAGAZINE.

However, it is interesting to know that the anthracite coal operators back of this organization are sponsoring such constructive engineering work.

As the result of one of these examinations, a recommendation was made to change from buckwheat to rice coal, which change would indicate a saving of nearly $25,000 per annum. In the other case, an exceptionally hard coating of metallic slag was found to accumulate between the tubes, choking the gas passages of the boilers to such an extent that it was necessary to clean the tubes externally every two weeks. After studying the operation of the plant and analyzing the coal and ash, a method was found for firing that practically eliminated the trouble.

# Heating Plants as Fixtures

*By John Simpson*

## 4. As Between Insured Owner and Insurance Company
## 5. As Between Owner or Mortgagee and Conditional Seller of Plant

IN an action on a fire insurance policy on a dwelling house, it was held that a heater, resting upon a brick foundation and surrounded by brick, extending about 12 in. above the top of the heater, formed part of the real estate that was covered by the policy: Adams v. Greenwich Insurance Co., 9 Hun. (N. Y.) 45.

As between owner and fire insurance company a furnace weighing about 1,500 lbs. placed on a brick foundation in a cellar was held part of the realty and covered by a fire policy insuring the house, although it could have been disconnected from the pipes without injury to the building; and a boiler attached to hot water pipes heated by the kitchen range was also held realty and covered by the policy. West v. Farmers' Mut. Ins. Co., 117 Iowa 147.

The owners may deal with radiators as personal property in insuring them, although they are such as will be held realty as between vendor and vendee or between mortgagor and mortgagee. See Watson v. Watson Mfg. Co. 30 N. J. Eq. 483.

### AS BETWEEN CONDITIONAL SELLER AND OWNER OR MORTGAGEE

An agreement of conditional sale of heating apparatus, not filed as required by N. Y. Personal Property Law 862, until after a part of it is installed in buildings under construction and until a mortgagee of the realty has made advances under the mortgages, is void as to the mortgagee. McCloskey v. Henderson, 231, N. Y. 130.

A complete steam heating apparatus, consisting of boilers to generate the steam, mains and pipes to carry it through the building, and radiators to distribute the heat, adapted to the use to which the property is devoted and intended by the owners as a permanent accession to the realty is a fixture and therefore realty. The radiators or the boilers cannot be considered as separate from the plant.

The owner may preserve the character as personalty of any article annexed to the realty if it is not so incorporated therewith as to lose its identity or to be incapable of removal except by destruction or serious injury to the freehold. This doctrine rests upon the owner's consent, express or implied; and this consent is effective.

Where a vendor of steam boilers and radiators intended they should become part of a complete steam heating apparatus under a contract between the vendee and the owner, and the owner had no knowledge of the conditional sale, and therefore did not consent that they should retain their character as personalty after annexation, the fixtures were realty, notwithstanding the conditional sale. Realty Ass'n. v. Conrad Const. Corp., 185 N. Y. App. Div. 464.

A similar case is Fitzgibbons Boiler Co. v. City of New York, 173 App. Div. 463.

Jermyn v. Hunter, 93 App. Dis. 175, 87 N. Y. Supp. 546 is a similar case, which has been frequently cited, relating to a steam boiler, hot water boiler and hot water heater purchased by a contractor under a conditional sales contract and bricked into the space they were intended to occupy in the boiler room of the building under construction as permanent fixtures. The owners of the building had no notice of the conditional sale. It was held that as between the vendor of the boilers and the heater and a purchaser at a mortgage foreclosure sale of the property, the title to the boilers and heater passed to the purchaser as part of the realty.

The court said: "If vendors of personal property seek to make a conditional sale they should be required to deal with the owner of the property, and not alone with the contractor without notice to the owner. Unless they do, there is no justification for imposing an incumbrance upon the building, without the owner's knowledge or consent. The Lien Law of the State (Laws of 1897, chap. 418, art. 1, as am'd) furnishes adequate protection for vendors of chattels which enter into the construction of realty."

Where a heating plant with warm-air furnaces, pipes, flues, registers, facings, etc., was sold to the contractor for a public school house. On condition that the title should remain in the seller until the price was paid, and installed without knowledge of the school board of this condition, it became part of the realty, and the seller could not recover it in replevin on the contractor's failure to pay. Peck-Hammond Co. v. Walnut Ridge School Dist., 93 Ak. 77.

A contractor for the heating apparatus for an apartment house in course of erection contracted for boilers for the heating system on conditional purchase. The owner of the building knew of this transaction. The property was deeded to a bona fide purchaser at foreclosure sale under a purchase money mortgage executed before the installation. The heating contractor failed to pay for the boilers. The seller sued the purchaser of the property for conversion. It was held that he could recover. Fitzgibbons Boiler Co. v. Manhasset Realty Corp. 198 N. Y. 519, 92 N. E. 1084, memo. opinion, on the dissenting opinion of Scott. J. in 125 App. Div. 764, 110 N. Y. Supp. 225, which decision was reversed.

The boilers here were removable without serious injury to the structure.

A portable furnace put in a cellar and connected with hot-air pipes and chimney, but removable without injuring the realty, installed under conditional sale contract, was not included in a prior mortgage where the mortgagee did not show lack of knowledge of the agreement. Duffus v. Howard Furnace Co. 8 App. Div. 567, 40 N. Y. Supp. 925.

Portable furnaces furnished under conditional sales contract are household goods and not fixtures and on the sale of the realty the title remains in the party who furnished them until paid for. Kerby v. Clapp. 15 App. Div. 37, 44 N. Y. Supp. 116.

### AS BETWEEN CONDITIONAL VENDOR OF PLANT AND CONDITIONAL VENDOR OF REALTY

The vendee in possession of realty under a conditional sale contract providing that in case of forfeiture for default in payments on the purchase price he should have no claim against the vendor for improvements entered into a written contract with a contractor to install a furnace in the dwelling house. The contract provided for the complete installation, with a provision that the title should remain in the seller until final payment, with the right to remove it for nonpayment. The seller of the property had no notice of this contract or knowledge of the installation until after it was made. The furnace was cemented to the cement floor of the basement. The conditional vendee of the property abandoned his contract and surrendered possession of the premises to the vendor. The seller of the furnace removed it from the house without the owner's knowledge or consent. In order to do this it was necessary to break the cement attaching it to the floor. The owner of the property sued the contractor to recover the value of the furnace.

The Iowa Supreme Court holds, Des Moines Improvement Co. v. Holland Furnace Co., 212 N.W. 551, that the furnace was not a trade fixture. It was attached permanently to the building, not only by being cemented to the basement floor but by the pipes in the walls and the registers in the floors. Openings were cut in the building, and the furnace and its attachments were fastened to the building in a permanent manner. It became a fixture and an integral part of the real estate.

As between the seller of the furnace and the conditional vendor of the realty it was held that the installation of the

furnace, making it a permanent fixture, without the latter's knowledge or consent, express or implied, deprived the former of the right to remove the furnace, notwithstanding its contract with the conditional purchaser.

Had the contract for the real estate contemplated or required that the furnace be installed, or had the vendor of the real estate consented to its installation, an entirely different question would have been presented.

The court followed a similar recent case, Ilten & Taege v. Pfister (Iowa), 211 N.W. 407, Dec. 14, 1926, where likewise there was a contract for the sale of real estate which did not contemplate the purchase and installation of a furnace. After a contractor had sold and installed a furnace, the purchaser of the real estate failed to pay the purchase price of the furnace, and a mechanic's lien was duly filed therefor. The purchaser abandoned the contract to buy the real estate. There it was held that the vendor of the realty retained the legal title of the property as security for the payment of the purchase price. His lien, therefore, was at all times paramount and superior to that of the seller of the furnace.

In that case also it was held that the furnace became an integral part of the building. The pipes were inclosed between the studding and the radiators installed in the floors or partitions on the second floor. The old furnace was removed and taken away by the contractor. It was possible that the furnace proper might have been removed without serious damage to the building, but, if this were done, the integral character of the improvement would be destroyed, and the radiators at least left to mar the rooms in which they had been placed.

The court also cited Hunt Hardware Co. v. Herzoff, 196 Iowa 715, where the circumstances were similar, and where it was held that the seller of the furnace to the conditional vendee had a lien upon the furnace under the contract for its installation, but it was inferior to that of the conditional vendee, whose contract provided that, in case of forfeiture, the improvements placed upon the land should belong to him, and who thereby became an incumbrancer.

AS BETWEEN CONTRACTOR AND OWNER, WHERE BURNED DURING CONSTRUCTION

In an action for labor performed and materials furnished under a contract for the installation of a heating plant in the defendant's dwelling house, which was destroyed by fire while in course of construction, the heating contractor was held entitled to recover the value of the labor and materials provided at the time of the fire, measured in terms of the contract. The different units which went to make up the completed heating plant became a part of the defendant's real estate when they were put in place, that being the intention of the parties, as shown by the evidence. Dame v. Wood, 75 N.H. 38, 70 Atl. 108.

AS BETWEEN CONTRACTOR AND MORTGAGEE OR PURCHASER OF REALTY

A nurseryman, tenant of greenhouses on a long lease purchased on the installment system a boiler and pipes for heating the premises. His lessor joined in the agreement. After it was executed, but before the boiler and pipes, which were fixed in brickwork, were installed, the premises were mortgaged. The tenant defaulted in payment of the installments and the contractor removed the boiler and pipes under the installment agreement. The mortgagee claimed that they had been affixed to the property without his consent and had become part of it and were irremovable as against him. It was held that the mortgagee, by allowing the tenant to remain in possession impliedly authorized him to carry on his business as nurseryman and to bring upon the premises, on conditional purchase terms, fixtures necessary for his business on condition of their removal by the conditional vendor or hirer, and having regard to this implied authority, his claim failed. Gough v. Wood [1894] 1 Q.B. 713, 63 L.J. Q.B. N.S. 564, 70 L.T. 297.

An innocent mortgagee or subsequent owner of realty, it was held, could not be bound by an agreement between the original owner and the seller of a heating furnace put into the house and set in a concrete bed, that the furnace should remain a chattel and be the property of the conditional seller thereof until paid for, and a subsequent innocent purchaser of the property was not barred from claiming that the furnace was part of the realty. Andrews v. Brown, 19 Manitoba Law Rep. 4.

## Canadian Plumbing and Heating Guild Hopes Soon to Begin Activities

With a membership of 315, and applications still coming in, the organization of the Canadian Plumbing and Heating Guild is almost ready to start active operation. Louis M. Singer, commissioner, has expressed the belief that the guild will begin functioning shortly. A charter has been issued, and a bulletin has been promised in the near future giving the names of all the operators, wholesalers and manufacturers associated with the guild up to date. A meeting of zone chairmen was held in Toronto, at which the manufacturers and jobbers were represented. Preliminary membership campaigning closed the 15th of August, and the guild is now devoting its attention to consideration and solution of trade problems. The zone chairmen in co-operation with the board of directors, are preparing a code for the industry.

A contest will be held to secure a satisfactory crest for use on letterheads, advertising, and literature, issued by members.

## A New English Heating Journal

Under the title of *Heating and Ventilating Engineer* a new journal, described as "exclusively devoted to every branch of heating and ventilating," has made its appearance in London. It is published by Frank William Tournay, Fulwood House, High Holborn, London, W.C. 1, and sells for six pence per copy and seven shillings and six pence per annum. Both in typographical appearance and editorial contents the initial issue of *Heating and Ventilating Engineer*, dated July, 1927, sets a high standard and the new journal gives promise of making a place for itself in the technical literature on this subject.

Notable articles in the first issue includes one by J. Roger Preston on "Temperature Clause, Its Difficulties, and an Alternative," one by Edward L. Joselin on "Considerations on Selecting A Fan," and one by Louis J. Overton on "Heating and Ventilating for Students and Beginners." The summer meeting of the (British) Heating and Ventilating Engineers is featured, with a double-page group photograph of those in attendance.

## Summer Meeting of the (British) Heating Engineers

"The Selection of Centrifugal Pumps for Various Duties," by A. G. Pullen, was the principal paper presented at the summer meeting of the (British) Institution held at Bournemouth, Eng., June 20-22, 1927, with President J. L. Musgrave in the chair. For the Technical Education Committee, Oswald Stott reported the progress that had been made in the organization of junior sections of the society. It is planned to organize such sections, first in Manchester and London. With the experience gained in those centers it was hoped that other sections would be formed rapidly. Mr. Stott said that the junior sections should eventually comprise more members than the institution itself. He estimated that there are something like 1000 employers in England and, therefore, that it was safe to assume the employees to number at least 3000 or 4000.

As now planned the junior sections will arrange their own meetings and will have their own organization, the institution maintaining only sufficient control for their proper guidance.

Following the meeting the institution held a banquet at the Hotel Burlington, Boscombe, at which the mayor and mayoress of Bournemouth were the guests of honor. Edgar Herring acted as toastmaster. On the day following the meeting the party made a tour through the New Forest via Salisbury to Shaftesbury where they were the guests of President Musgrave. The return journey was made via Blandford.

# Health and Ventilation

*By Peter H. Bryce, M. D.*

## 5. The Cooling and Ventilating of a Unit Dwelling

SOME years ago I was asked by the manager of a large printing plant, where I had installed a very satisfactory humidifying machine, if I could not find a means of reducing the temperature in the large office room, which, with windows on the east and south, used to reach sometimes 100° F. in midsummer.

It is apparent that the problem is quite the opposite to that of keeping a house warm in winter, and yet some of the same conditions enter into both. Thus, in our model dwelling, we have walls so constructed that the insulation of the walls and roof is almost complete and the transfer of heat on a zero night, or its loss, need not exceed 1° F. per hour. It is apparent that the same rule will apply to keeping out the heat of the sun in summer. I had studied the principles of scientific refrigeration as applied to the conservation of foods and so was glad to have the opportunity of studying the problem of keeping houses cool in summer.

What was impossible a few years ago is now quite practicable, through the invention of the electric ice-making machine, of which installations of from a ¼-ton to a 1-ton machine are being multiplied in every large city and town where electricity is available. The application of the principle to cooling house air is based upon the fact that a 1-ton ice-machine will produce cold equivalent in amount to that obtained from melting 1 ton of ice every 24 hrs. This means the absorption by each pound of ice of enough heat to change it into water at 32° F. In other words, 1 ton of ice absorbs or renders latent 284,000 B.T.U.

Keeping this fact in mind, we turn to the problem of how to maintain the atmosphere of our unit dwelling-house at a temperature of from 70° to 75° F., and a normal humidity, through our long, hot summers. It is apparent that we must determine the amount of work to be done to keep 30,000 cu. ft. of house air at the above temperature, which otherwise might reach an afternoon temperature of 90° F. or over. We already have seen that it is possible to reduce the loss of the house temperature on a zero night in winter to 1° F. per hour, for eight successive hours through well-insulated wall construction. The first means to adopt is to utilize this insulation, so far as possible, to keep the heat out. This is done by closing all doors during the day and placing shutters or shades over the windows where light is not required and so still further exclude the heat of mid-day.

We must assume, however, that even with these measures, the steady infiltration of outer air into the house will continue and that it will be found at least as high as 80° F. at 4 A.M. much of the time in summer, and often over this. It is common experience that exposure for months to high temperatures during the day, if not relieved by cool nights for sleeping, becomes very exhausting to the nervous system, and a serious loss of effective energy must result. Obviously, the first step is to utilize the minimum temperature of 4 A.M. of the outer air, which we shall suppose to be 80° F. or lower, and let it sweep through the rooms by cross currents from a few windows, till after sunrise, and then close the windows and shades.

But we must further actively antidote an increase of temperature of at least 1° F. per hour for at least 12 hrs. of sunshine. This we propose to do by placing an electric ice-making machine in our operating room in the basement, equivalent in cold-producing capacity to 1 ton of ice in 24 hrs. In other words, we are going to produce 284,000 units of cold during this period and apply it to the reduction of the temperature of the dwelling.

We shall assume that the "effective temperature," as shown by the experiments in the Research Laboratory of the American Society of Heating and Ventilating Engineers, for our dwelling is 70°, with a relative humidity of 55%, fulfilling the three necessary conditions of proper temperature, humidity and air movement suitable to the inmates dressed in the ordinary manner, and engaged in their usual tasks. This implies an air movement of at least 1 ft. per second, which will be secured by an electric fan, also placed in the operating room in the basement. This will circulate 30,000 cu. ft. of air per hour through ducts having a capacity of 10 sq. ft. to the rooms, from which return ducts will carry the house-air back to the operating room to be cooled and its excess of moisture precipitated in the ice-machine as frozen vapor.

As already mentioned, 1 ton of ice creates 284,000 units of cold in 24 hrs., so that if the house-air increased in temperature every hour during the twenty-four, it would require just a 3-ton machine to keep 30,000 cu. ft. of air at a normal temperature of 70° F. when once obtained. Fortunately, the radiation of heat through at least half the hours of the day will exceed the increase during the other half and a balance will be maintained approximating the temperature proposed.

### ADAPTABILITY OF ELECTRIC ICE MACHINES FOR HOUSE COOLING

As we know, the electric ice-machines installed in houses have been used for the conservation of food and have their carbonic acid or sulphur dioxide tank in the basement, with motor and pump attached, while cold pipes are carried to the refrigerator adjoining the kitchen. Fortunately, our unit dwelling has been so constructed that practically no alteration is necessary for the installation in the operating room of an ice-machine. It will be recalled that the hot-water radiators are installed in an operating-room adjoining the furnace, so it will readily be possible to utilize the hot water radiators as an air-cooling system. It is usual in ice-machine refrigeration to have the expansion pipes from the cold-producing gas cylinder carried through a brine tank, whose cold is then transmitted to the circulating cold water pipes. In our case, it will be only necessary to have a header from the hot water pipes placed within the brine tank and thus transmit the cold to the system of radiators and thereby cool the air returning from the rooms.

It will be recalled that in our unit dwelling a fresh-air duct leads to the outer air and that a damper is placed in it to regulate the amount of fresh air admitted. Obviously, it is not desirable to admit the heated outer air if any means can be found of previously reducing its temperature. I have assumed that the unit dwelling has ground space around it, and that it is readily possible to have outer air drawn through a duct in the ground, when the temperature is 48° F. Not only has cold ground air been so utilized, but there are to-day in various places deep wells, sometimes artesian, as in Ottawa, where hundreds of tons of refrigeration are required in a city dairy and water from an 1800-ft. deep boring, with a ground temperature of 48° F., is used for the condenser of the ice-machine. But the most recent remarkable application of ground temperature is in the cooling and ventilating system of the Minneapolis Auditorium, where 3,000,000 gal. of ground water at a temperature of 49.5° F. are pumped through circulating pipes to cool 413,000 cu. ft. of air per minute supplied for an auditorium capacity of 18,100 persons in a building covering two whole city blocks. In this beautiful installation provision is made for cooling the air and then circulating it through the cooling chambers where its moisture is precipitated in the pipes and its humidity reduced as the cooled air is delivered into the warmer air at the numerous inlets, being driven by fans.

It will be apparent, having brought the air in our unit-dwelling to a temperature of 70° F. in the operating room or cooling chamber, that our problem

is reduced to one of keeping the room air in motion by a small fan and bringing it back to the cooling chamber, where only as much outer air is admitted as will maintain the desired temperature.

From what has been said, it is apparent that various means may be found to assist the work of the ice-machine. In practice it can be asserted with perfect confidence that a 1-ton ice-machine, used in the manner indicated, will go a long way in solving the problem we have undertaken to investigate. Refrigeration is being adopted in steamships going through the tropics and, as we have seen, is being installed in auditoriums and in rinks. In order to make the house atmosphere tolerable and even enjoyable "Jack Frost" air and "Frigid Air" machines are being added to the amenities of housekeeping in many houses, and it is proposed that we complete the task by so treating our house-atmosphere, which must be lived in during much of the 24 hrs., that comfort can be assured and strength conserved. Thus the dream of hygienists will be realized and statistics will be able to prove to us that a man of fifty is still going strong, at seventy he is only beginning to reduce somewhat his daily activities, and that by one hundred he has only begun to grow old gracefully.

*The next article will deal with the effect of house-dust on home-dwellers.*

## Week Devoted to Fire Prevention

Fire Prevention Week is to be observed October 9-15, for which considerable publicity has already been mapped out. The Fire Prevention Handbook, sent to all members of the National Fire Protection Association, gives elaborate suggestions for campaign plans, window displays, observance in schools and inspection blanks. Copies are available to individuals at 15 cents each, or 10 cents each in lots of 100. Other display material is issued from the National Board of Fire Underwriters, 85 John St., New York. T. Alfred Fleming is chairman of the committee.

## Conditioned Air for Jail Believed an Aid to Criminal Reformation

Working on a theory held by several well-known penal experts that one important aid to curing crime is plenty of light, and clean, fresh air, a model jail has recently been constructed at Houston, Texas, in which so-called "made to order" weather is provided. Fans draw the air from outside, pass it through air filters to remove dust and dirt particles and out over heating coils to give it proper temperature. Ducts distribute this air to all cell rooms at a rate of 30 cu. ft. per min. for each individual.

With the advice of Dr. Hastings H. Hart of the Russell Sage Foundation, a national authority on penal institutions, working in co-operation with the architects and building committee, county officials headed by Judge Chester Bryan inspected jails in Memphis, St. Louis, Chicago, Buffalo, New York, and other cities, for the purpose of determining the desirable features in these various institutions. The results of their survey are manifested in this new jail, in which ventilation is brought out as an essential factor in the health and possible reformation of the criminal.

## Summer Heating-Plant Repairs Urged

One of the leading articles in the August bulletin of the National Trade Extension Bureau is a plea to heating contractors to secure and carry out all possible heating-plant repair jobs before the beginning of cold weather.

It is suggested that a series of form letters, written especially to solicit this kind of work, can be found in the compilation prepared by the bureau under the title "Successful Sales Letters for Heating and Piping Contractors."

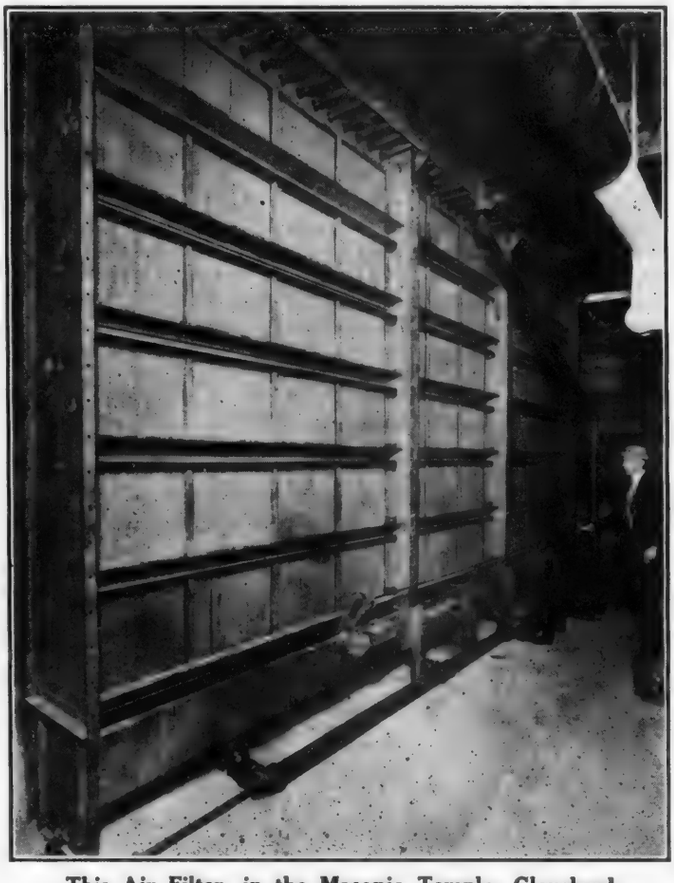
The article outlines methods of approach, when personally soliciting repair jobs, and demonstrates that a large volume of this class of work is available to the heating contractor who will go out after it.

## Automatic Air Filters in Cincinnati Masonic Temple

Designed to cleanse 293,000 cu. ft. of air per min. for the auditorium and other rooms of the Masonic Temple in Cincinnati, a battery of six self-cleaning filters has been installed by General Air Filters Corp., New York. Cleansing of the filter plates is accomplished by flooding them with a viscous oil and collecting the oil in a tank under the assembly. The flushing pump automatically is started through a General-Electric relay when the blower motor circuit has been cut off. A time limiting device shuts the flushing-pump motor off after 7-10 minutes of operation. During this period, the mud-ejector mechanism and the scraper conveyor are in operation, removing the solid matter from the bottom of the flushing tank.

It is a question just how long such an automatic cleaning device will operate without requiring manual cleaning as it is conceivable that the flushing of oil over the filter will not remove every vestige of dirt.

Such a condition has been provided for in this filter by making the filter element removable for hand cleaning, should this ultimately become necessary.



**This Air Filter, in the Masonic Temple, Cleveland, Is Automatically Cleaned**

# The Business of Contracting

## Part IV—Building Up a Cost System

TO make contracting a real business the contractor must be business-like and know at all times approximately where he stands. Contracting is really a difficult proposition in this respect owing to the obligations incurred in undertaking contract work, and the larger the contracts handled the more uncertain the financial position of the organization, that is, as far as accurate accounting is concerned. No saying is any truer than that a contract is never completed until the final payment is made; and to that also might be added, "and until the guarantee has expired."

### LACK OF DUPLICATING JOBS

The greatest difficulty seems to lie in the lack of similarity between jobs; not only are there several classes of work, such as super first-class, good—but not unduly expensive—cheap work, and competitive installations, but there are also gravity steam systems, vapor steam systems, hot water systems, vacuum systems, coal, gas and oil-fired propositions, jobs with ventilation and without, indirect heating, fan systems, unit heater systems and so on indefinitely. In addition to this is the fact that all these different types of work are again subdivided into various types of buildings running from residences and garages up to office buildings, schools and hospitals.

It may be stated with truth that not one contractor in ten gets three jobs in a year that are so closely duplicated that the cost on one will compare closely with the cost on another. If all other signs fail the difference in location and accessibility may make quite a change in the cost.

With these conditions to combat, it is small wonder that some contractors grow discouraged with the endeavor to make their costs even remotely compare. And yet, when costs are carefully and consistently kept, it is astonishing how closely similar jobs will run. For this reason all jobs on completion should have their costs carefully compared with the estimates previously made, not so much with the idea of doing any good as regards past work—which is done and finished—as with the idea of gaining an insight into what parts of the work were estimated too high and what parts were estimated too low. This knowledge will prove invaluable on the next estimate and may make it possible either to secure work at a price still leaving a profit, or to avoid taking work on which there is no possible chance to make a profit before the job is even begun.

### MAKING A COST SYSTEM DEPENDABLE

To make a cost system fool-proof every dollar spent must be charged to some item or classification and the more that can be charged directly to the contracts the better, and more accurate will be the estimate. Every dollar paid out for wages should be charged to some account from the time slip turned in by the employee showing what job he was working on, for which the wages are paid. Every purchase order should be charged to the job or to "stock" and a stock account carried so that the value of every pipe fitting on hand is ascertainable immediately. Even material removed from an old job, which is not absolute junk, should have a reasonable valuation assigned to it and should be carried at this valuation until sold, used, or scrapped, at which time it can be charged off to the job where used or to a loss, if it is discarded as being entirely worthless.

WEEKLY TIME CARD

| Date | Began | Stopped | Time | Rate | Amount | Job |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| Note: Charge Overtime on Back | | | | | | TOTAL |

**Fig. 9. A Simple Form of Time Card on Which All Necessary Information Is Given**

### SIMPLE FORM OF TIME CARD

A simple time ticket is shown in Fig. 9, the essential information necessary being the job number on which the man worked, the date, what the work consisted of, the man's name, rate of wages and amount. Sometimes the rate of wages and amount are omitted and only the hours shown. In this case the hours would be posted off the slips onto the payroll account and then posted again on the proper job number for cost purposes, the payroll being computed weekly, from the total time shown as being charged up for each employee, and the cost sheets being figured out from time to time during the progress of the work or on completion of the job, as desired.

As soon as any particular job is completed the cost is figured out and placed on the bottom of the contract or job sheet, then this cost is subtracted from the contract or job price and the result is the profit made on the particular job. If the cost is greater than the price charged, then, of course, there has been a loss sustained on that particular contract.

### SUB-DIVISION OF COSTS

It is sometimes desirable for purposes of future estimates to divide a job into several parts, keeping the cost on each part separate so as to know just what some particular part of the work costs to install. This may be accomplished in either of two ways; the same job number may be used for the entire contract and each part may take a designating letter, or different numbers can be assigned to the portions of the work to be segregated. Thus, in the first instance, if it were desired to keep separate costs on the heating installation and the ventilating work, and the contract number happened to be No. 128, then the heating work all could be charged to 128-H and the ventilating work to 128-V. With the other scheme the contract would be listed separately as No. 128 and the ventilating work as 129, and the whole installation would be run as two entirely separate and distinct jobs.

### DEVELOPING THE PERCENTAGES

It generally requires a year of trial operation with such a system (where no records have been kept previously) to develop the proper percentages to allow for overhead and indirect material and labor. After these are determined they may be used in estimating work for the succeeding year and in figuring costs during that period. In other words, the overhead and indirect material for this year are based on the percentages obtained from running the business for last year. The reason for this is that the percentages for the current year will not be available until the end of the year, so during the year the latest figures, that is, the percentages shown during the previous twelve months, are used until more recent figures are developed.

### ESTIMATING BY THE QUANTITY AND UNIT METHODS

In estimating for new work there are two methods, and for the ordinary class of work it is questionable as to which method is most desirable and accurate. One method is known as the "unit cost" method and the other method is based on the "quantity count" from the plans. Where work is not laid out in detail, with every pipe shown and sized, the unit method not only is the most practical but is really absolutely necessary, unless the contractor is prepared to go to the extent of doing all the engineering work on such estimates; this is not only quite a laborious operation, but also a highly expensive one. If unit prices are used, the calculation of the estimate is much simplified and no engineering work is necessary.

On special work of unusual character it is necessary to take off quantities, estimate the labor, and figure in detail

Hot Water
Steam
Ventilating
Special

ESTIMATE

No. _____
Date _____
Made by _____

for _____
Address _____
Work _____

| Size | Description | Quantity | Cost | Amount | Labor | Amount | Total |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | Contingencies | | | | | | |
| | Total | | | | | | |
| | Indirect | | | | | | |
| | Total | | | | | | |
| | Profit | | | | | | |
| | Grand Totals | | Material | | Labor | | |

**Fig. 10. Typical Estimating Form Suitable for Either Unit or Quantity Estimating**

every item entering into the installation of the job; this is because unit prices are, in a way, average prices, and will fit only average jobs. Another point to be considered in deciding whether to figure a job by the unit or quantity method is the size of the work. As a general rule larger jobs will run more true to form, as far as unit prices go, than smaller jobs; it is plain that a unit price developed from work involving 30 to 100 radiators might not, and probably would not, be a true cost when applied to a job with only five or six radiators.

### DETERMINING UNIT COSTS

The best way to use unit prices is to develop them for standard portions of the work, such as the price per square foot for radiators and piping installed with ordinary automatic air valves and common angle-type radiator valves; a second price for the same set-up with graduated valves and thermostatic traps; a third price for hot water systems. Or sometimes the cost is worked out for the piping and valves, only leaving the radiation and boiler to be figured separately.

For ventilation work the cost per square foot of galvanized-iron duct can be determined, with the grilles and fans, motors, and heaters figured separately. Where systems are not yet laid out, approximate estimates can be made by determining the cost of similar systems based on the cubic feet of air handled per minute; in such cases it would have to be remembered that the results would be very approximate, as the variation in velocities and length of runs would have to be considered for the work being estimated in relation to the job from which the unit prices were developed.

### DETERMINING COSTS BY QUANTITIES

Where the quantity method is used, every pipe must be scaled, every fitting counted, and the labor estimated for erection. The chief difficulty in quantity-estimating lies in the minor items which do not and cannot be shown on the plans; these items include cutting oil, red lead, pipe hangers, cartage, cutting, patching, removal of defective fittings, tests, and many other minor items which are small individually but constitute a considerable amount in the aggregate. This is where the unit method comes out stronger, as a unit price includes any and all of these factors which will occur in the ordinary installation.

### ESTIMATING SHEET

For the purpose of estimating by either method a common form of sheet is best; that is to say, a sheet which lends itself to being used for either unit or quantity work. A good form is shown in Fig. 10 which is a sheet, simple in form, yet containing all the essential elements for estimating by either method. It might be pointed out here that many contractors make it a practice, when estimating by the quantity method, to check the results by the unit method to see that the quantity cost as estimated compares within reason with the cost obtained by the unit method. The ease of computing by the unit method makes this checking a matter of only slight effort and any radical difference which shows up would be sufficient reason to question the figures and to go over them looking for errors.

Besides the general information at the top of the estimate sheet, shown in Fig. 10, which is self-explanatory, the estimate itself is written in the blank spaces below, the first column being the size, the second column the description, and the third column the quantity of material of that particular size. The fourth column is for the net unit cost of the material, and the fifth column the amount; the sixth column is the labor allowed per unit of the material, and the seventh column the amount of labor chargeable to that particular item of material.

It will be noticed that in this sheet the amounts for labor and material are kept in separate columns and this renders it easy to add different percentages for indirect labor and indirect materials, as well as overhead and profit.

## New Processes Will Be Shown at Chemical Industries' Exposition

Exposition of the Chemical Industries, at the Grand Central Palace, New York, September 26 to October 1, will portray an industry which has grown three times greater than in 1921. There will be from 350 to 400 exhibits, some of which will demonstrate new aspects from which chemistry has become important.

More than 62 industries will send representatives to study the exhibits, secure ideas, and observe changes taking place, not only in their own fields but in kindred fields, which may influence their own operations. Many firms, in addition to those exhibiting last year, have signed up for space and will exhibit for the first time.

The fifth banquet of the chemical industries, under the auspices of the Salesmen's Association of the American Chemical Industry, will be held at the Hotel Roosevelt, September 28. About fifteen associations and societies of the industry, co-operating with the exposition, will participate in the banquet.

## New Name for Los Angeles B. T. U. Club

Heating and Ventilating Salesmen's Club of Los Angeles, Calif., is the new name of the B.T.U. Club, of that city, which has been functioning for the past eight years. New constitution and by-laws were adopted at a recent meeting, and a code of ethics for the guidance of members was approved.

Various methods of organization, such as the board of directors' plan, the committee plan, the trustee plan and others, were practiced in the past, but none seemed to be as effective as desired. It then was decided to change the name of the club and effect a reorganization, with the group idea, of the salesmen interested in heating and ventilating. There now are twelve groups, each headed by a chairman elected by members of the group.

The club will meet regularly on the second and fourth Tuesdays of every month at 2714 South Hill St., Los Angeles.

New officers elected are: Chairman, A. W. Merrill, vice-chairman, E. A. Simons; secretary-treasurer, John W. Crawford.

## Heating Plant Has Surplus

For the first five months of 1927 the city of Winnipeg Central Heating plant had a surplus of $22,211 as against a deficit of $3,499 for the corresponding period of 1926, or a gain for this year of $25,710.

# Grates for Burning Small-Sized Anthracite

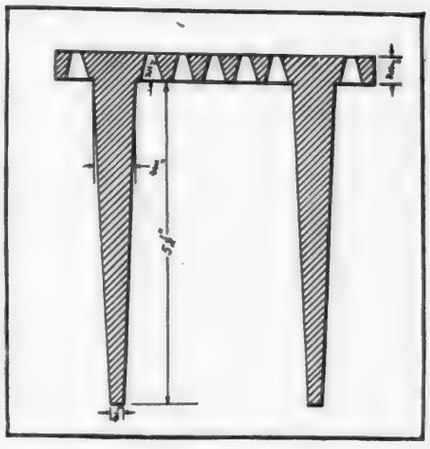
*Previous articles in this series are as follows:*

1.—*Neemes, October*, 1926.
2.—*Johnson, November*, 1926.
3.—*Rath, November*, 1926.
4.—*Pyramid, December*, 1926.
5.—*Culm-Burn, December*, 1926.
6.—*Atlas, January*, 1927.
7.—*Spencer Heater, February*, 1927.
8.—*Grieve Grates, March*, 1927.
9.—*Tread-Kill, April*, 1927.
10.—*Economy, May*, 1927.

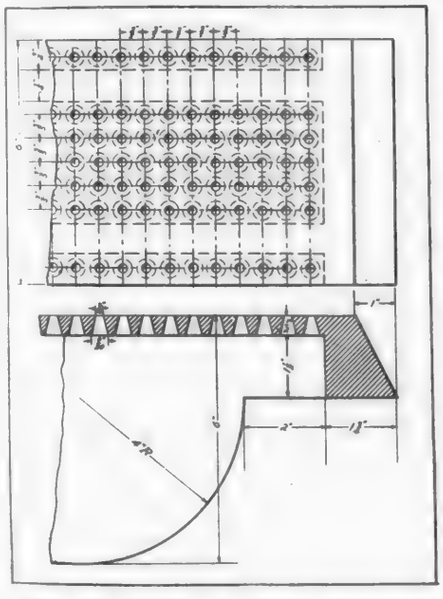
## 11. Oxykol

IN the Oxykol system of combustion, which is marketed by the Oxykol Co., Philadelphia, Pa., use is made of specially-designed air-cooled grates in the form of built-up units, operating in connection with an internal system of automatically-controlled forced draft. The openings in the grate through which air is admitted to the fire-bed are constructed in a manner to prevent unburned coal from falling through into the ash-pit, at the same time permitting the air to be distributed evenly over the entire grate area, to insure an even fire.

The draft unit, which is a part of the system, consists of a direct-connected motor-driven blower, constructed to reduce air noise to a minimum. In this system the air necessary for combustion is forced into contact with the fuel and the draft is controlled automatically either by steam pressure, air thermostat or temperature of the water in the boiler. In the average installation the draft unit is designed to operate until the steam pressure, the temperature of the building or the water temperature reaches a predetermined point when the draft unit is cut off automatically. The fire then maintains itself by natural draft until the predetermined minimum pressure or temperature is reached, when the cycle is repeated.



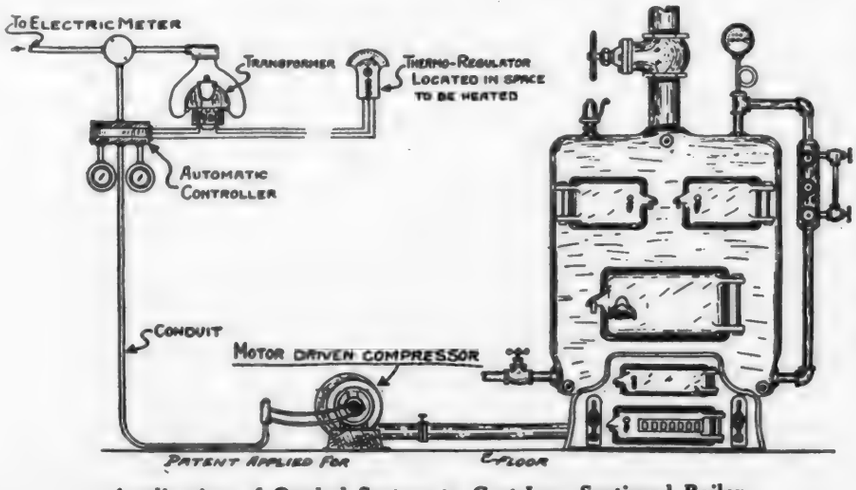
Detail of Oxykol Grate



Plan and Section of Oxykol Stationary Grate

In the accompanying table the figures given are the result of tests in which, in one case, anthracite coal, stove size, was burned in an ordinary steam boiler, and, in the other, where anthracite buckwheat was burned in the same boiler after it had been equipped with the Oxykol system.

| | Boiler equipped with ordinary dump grate, burning stove coal | Boiler equipped with Oxykol system, burning buckwheat coal |
|---|---|---|
| Duration of test, hours | 8 3/4 | 8 |
| Mean temperature outside, deg. F. | 41 | 36 |
| Mean temperature inside, deg. F. | 66 | 65 |
| Difference in temperature, deg. F. | 25 | 29 |
| Grate area, sq. ft. | 17 | 17 |
| Coal consumed (excluding banking) pounds | 1200 | 1275 |
| Coal consumed per hour, pounds | 137 | 159 |
| Rate of consumption, per square foot per hour, pounds | 8.1 | 9.35 |
| Cost of coal per ton (2240 lbs.), dollars | 15.50 | 7.50 |
| Cost of coal consumed, dollars | 8.30 | 4.27 |
| Cost of coal per hour, dollars | 0.95 | 0.53 |
| Cost of coal per degree difference in temperature per hour, dollars | 0.038 | 0.018 |




Application of Oxykol System to Cast-Iron Sectional Boiler

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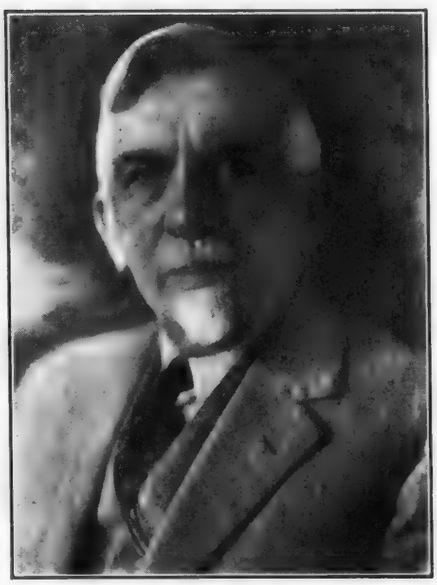
THIS IS THE HOUSE THAT DAD BUILT appears on the cover of a circular received from the Baker Steam Motor Car and Mfg. Co., Pueblo, Colo. Illustrating the idea is a series of contrasting sketches to show how a home was heated in the coal age, and how it is being done in the oil age. Inside the cover is an interesting photograph of the Country Club Court in St. Louis, Mo. There are eighteen houses on both sides of this block-long court. It is stated that the installation of the first burner in the court was so satisfactory that every house in the group now enjoys the benefits secured by burning oil in a Baker burner.

A second booklet contains a score or more of testimonial letters written by Baker owners in different parts of the country.

BAILEY METERS for recording salient factors in boiler operations are featured in Bulletin No. 43-A received from Bailey Meter Co., Cleveland, O. This bulletin is devoted to stories of savings effected by using Bailey meters. It is replete with facsimile charts to accompany each story. The bulletin should be of value to anyone interested in boiler performance. Size 8 in. x 10½ in. Pp. 8.

# Details Announced of Boiler and Radiator Merger



**John H. Waters**
Chairman, Board of Directors, National Radiator Corporation

**Edward Norris**
President, National Radiator Corporation

As announced in THE HEATING AND VENTILATING MAGAZINE for July, a new and powerful coalition in the heating industry has been effected through the merging of six important concerns into the National Radiator Corporation, which has been chartered in Delaware and capitalized at an amount in excess of $25,000,000.

Financing of the merger was arranged through the Bankers Trust Company, New York, and other prominent banking interests of New York and Chicago.

The new corporation acquires the properties of the National Radiator Co. and Union Radiator Co., Johnstown; Gurney Heater Mfg. Co., Framingham, Mass.; Continental Heater Co., Dunkirk, N. Y.; Utica Heater Co., Utica, N. Y., and Niagara Radiator and Boiler Co., North Tonawanda, N. Y.

The consolidation involves ten plants —two each at Johnstown and New Castle, Pa., and one each at Trenton, N. J., Utica, Dunkirk and North Tonawanda, N. Y., Framingham, Mass., and Chicago, Ill. The plants are well-equipped and advantageously maintained with respect to principal markets and to the supply of raw materials. They have a total annual capacity of radiators of approximately 60,000,000 sq. ft. and more than 90,000,000 lbs. of boilers. The companies maintain warehouses and branch offices in New York, Boston, Philadelphia, Chicago, Cleveland, Pittsburgh, Baltimore, Cincinnati, Richmond, Washington, and other important cities throughout the East and Middle West.

As a result of the merger, the new corporation will be the second largest manufacturer in the world of hot water and steam radiators and cast-iron boilers for heating purposes. Products manufactured comprise radiators of all the standard sizes and types; cast-iron boilers, both round and sectional, for burning hard coal, soft coal, coke, oil and gas; warm-air heating apparatus and hot water supply boilers.

The new corporation will maintain the same policies as to manufacture and distribution, and the managements of the old companies will have substantial interests in the new organization.

Until the problems of co-ordination are fully worked out, it is expected that the constituent companies will operate largely, as in the past, as separate units. Plans for consolidating sales facilities in various cities will proceed only after a careful study of the personal and trade problems involved.

Through the strategic location of plants and warehouses, the company will be in position to serve the entire United States, and, by easy access to water transportation, will be prepared to enter important export markets.

Within the last four years the production by the constituent companies making radiators, measured in square feet of radiation surface, has been increased 73.2% as compared with an increase of 14.6% for the industry as a whole (a gain of 5 to 1 in favor of the new coalition). Meanwhile, the production of boilers, expressed in pounds of iron used, increased 35.6% as against 16% for the entire industry (more than 2 to 1 in favor of National and its allies).

John H. Waters, president of the National Radiator Company since 1896, becomes chairman of the board of the consolidation. Edward Norris, president of the Utica Heater Company since 1911, has been elected president and will take up his new duties as soon as general offices in Johnston are established. Edwin C. Andrews, president of the Niagara Radiator and Boiler Company, is to become chairman of the advisory committee. Other officers will be appointed from those who have so successfully administered the affairs of the constituent companies.

Gurney Heater Mfg. Company originally began in Canada, later establishing a plant in Framingham, Mass. The merger involves only the American plant, the company retaining its Canadian properties. The present generation is the third of the Gurney family in this industry. The firm has been a powerful factor in the New England market, particularly. The Framingham plant soon will be on a 100% basis of production of the new-type radiation.

Nigara Radiator and Boiler Company, Inc., established about 30 years ago, came under the control of the present management, with E. C. Andrews as president, about 20 years ago, and now has, in addition to its plant at North Tonawanda, a modern factory at Chicago, manufacturing round and sectional boilers and radiators.

Continental Heater Corporation was started 15 years ago by John W. Watson and E. C. Reed, who have continued to be the dominant factors in the company. Its factory is at Dunkirk, N. Y., where the company's line of boilers and radiators have been built.

Union Radiator Company has been operating for 22 years at Johnstown, Pa. During that entire period it has been under the active management of Herman E. Baumer. At the present time its plant is turning out nothing but the new type of radiation, and its production in the last five years has increased 500%.

Utica Heater Company makes smokeless boilers, coal and coke boilers and warm-air heating systems. It was founded in 1882, incorporated in 1900, and, since 1911, has been under the management of Edward Norris, its president.

National Radiator Company, at Johnstown, springs from a small radiator plant, the long-extinct Fowler Radiator and Manufacturing Company, established at Norristown, Pa., in 1894. John H. Waters and his brother, Samuel B. Waters, later became interested, and in 1896, assuming control of its policies, decided to move it to Johnstown in order to be closer to the sources of raw materials. In 1902 the company was reorganized as the National Radiator Company of Pennsylvania.

In 1911 a plant was opened at Trenton, N. J., to serve more easily the eastern market, which plant since that time has been greatly enlarged. In 1918 the company purchased the plant of the

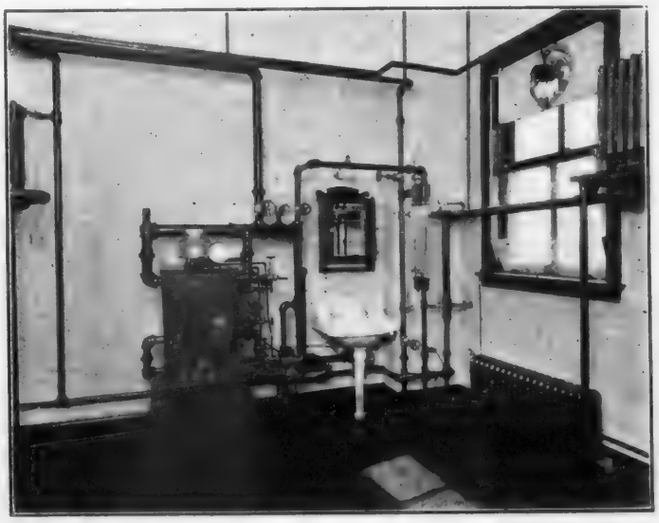
Federal Radiator Co., at New Castle, Pa., and went more extensively into the manufacture of boilers. Since then an entirely new plant for radiation has been completed at New Castle.

In 1911 a great contribution was made to the industry by the National Radiator Company, when it embarked upon the standardization and simplification of radiator designs. Up to that time there had been two chief types—plain and ornamental—and distributors were forced to maintain a stock of both types. The company decided upon a plain type of radiator, with nipple connections at top and bottom.

The present consolidation is believed to have been hastened by the development of the new-type radiation pioneered by the National Radiator Company in its first "Aero" model, which was awarded the gold medal at the Philadelphia Sesqui-centennial last year. Other companies in the merger are also making new-type radiation, so that the new corporation will be able to meet the increased demand on the part of the public, the architectural profession and the heating trade for this greatly-improved product.

## Visualizing the Operation of a Heating System

A complete working model of a controlled-heat system in operation to demonstrate the working of the differential loop has been set up in the home office of the Hoffman Specialty Co., Chicago. This hook-up serves to maintain a constant-pressure differential between the steam main and return line, whenever boiler pressure exceeds a predetermined or unsafe amount. One side of the loop is connected into the steam side of the boiler, while the other is joined to the high point of the return mains. The model on display is built of glass so that the action of the steam and water can be seen. It is of particular interest to contractors and engineers as an automatic safety device for vapor systems.



**A Heating System Built of Glass—to Show How it Works**

# Power Show Plans Rapidly Rounding Into Shape

The Sixth National Exposition of Power and Mechanical Engineering will be held at the Grand Central Palace, New York, December 5-10, when the annual meetings of the American Society of Mechanical Engineers, the American Society of Refrigerating Engineers, and assemblages of other organizations in the power-generating field will gather at the same place, and co-operate with the exposition in producing an unusually comprehensive program.

There are already more exhibitors signed up than last year. Some 400 exhibits of power generation, distribution and utilization will be displayed. Between 200 and 250 exhibits of heating and ventilating equipment are going to be featured. Refrigeration for large-scale industries, factories, office buildings, apartments, public and assembly buildings, and homes will be among the interesting shows of the exposition. Over 100 exhibits will demonstrate instruments for control of time, pressure, temperature, volume, and other implements required for precision in measurement and recording of such facts. There will be approximately 125 exhibits of machine-shop equipment, including metal and wood-working machines, transmission equipment, tools and machine tools. Outstanding exhibits of new transmission equipment will be on review. Other features will include material-handling equipment, and mechanical equipment of all kinds for inducing efficiency in various types of industrial plants. At the present date more than 500 exhibitors have signed for space.

Many unusual educational exhibits are under way, to which it is expected that representative engineers, manufacturers, technical and construction men, and plant and building operators will be attracted.

The advisory committee of the exposition co-operating with the management includes: I. E. Moultrop, chairman, Homer Addams, F. Paul Anderson, N. A. Carle, Willis H. Carrier, Fred Felderman, C. F. Hirschfeld, O. P. Hood, John A. Hunter, E. B. Katte, R. T. Kent, John H. Lawrence, Fred R. Low, David Moffatt Myers, R. F. Pack, Fred W. Payne, Calvin W. Rice, Charles F. Roth, and Charles M. Schwab.

Inquiries regarding the exposition should be directed to the International Exposition Co., Grand Central Palace, New York.

## Status of British Heating, Ventilating and Sanitary Engineering Trades Revealed by Census

The London Board of Trade is issuing in sections a survey of the census of production in the United Kingdom, taken in 1924, of which a late section covers the heating, ventilating and sanitary engineering trades. This contains a statement showing the manufacturers' selling values, and the quantities of goods of various classes produced in 1924 by firms in these industries. This census, being the first made since 1907, cannot be compared with the previous report, for the former included installation jobs and other factors which have been omitted from the 1924 analysis.

A more detailed classification was adopted in the last census, and in some cases there was a regrouping, so that in the new statement it is interesting to see just what industries fall under sanitary engineering, and those that, according to the British point of view, belong in the heating and ventilating field. In the 1924 census the principal items are:

| | |
|---|---|
| Gas and water pipes (including radiators) of iron or steel, 29,800 tons, with a selling value of | $3,850,000 |
| Heating appliances | 5,750,000 |
| Ventilating appliances | 2,000,000 |

All the merchandise produced in the heating, ventilating and sanitary fields aggregated $88,200,000 in 1924. The value of heating and ventilating appliances as given above also is to be supplemented by $2,200,000 on schedules returned from the general engineering trades.

Census figures showed that the only important competition from imported goods came under the classification of sanitation.

There were employed, during 1924, at the factories and workshops in the heating, ventilating and sanitary field, 47,620 people, of whom 42,044 were recorded as operatives and 5,576 as management, clerical and technical staff.

# Committee D-2 Simplifies Domestic Oil-Fuel Classification

BY putting oil fuels under two general classes, Committee D-2 of the American Society for Testing Materials, in issuing its report, has greatly simplified the designation of oil fuels for domestic use. Class "A" includes the distillates related to kerosene, while Class "B" includes the light fuel-oils. The former approximately may be considered as those above 34° A.P.I., and the latter as covering the range between 24°-32° A.P.I. No attention is paid to the gravity of fuels in the new classifications.

Essential points in the new specifications are:

Flash—For class "A" oils, it is desirable to specify minimum and maximum flash points. The minimum flash point is necessary for compliance with legal requirements. The maximum flash point should be above 150° F. in all cases, and for localities where the minimum flash point is 150° F., closed cup, it should be above 165° F. For class "B" oils only a minimum flash point is considered necessary. A minimum of 150° F. closed cup, is believed to be adequate to cover all legal and Underwriters' requirements.

Water and Sediment—Class "A" oils should substantially be free from water and sediment. Class "B" oils should reasonably be free from these substances, but should not be expected to be as clean as class "A" oils.

Pour Test—If some indication of the solidification point of class "A" oils is desired, the pour test should be applied. A maximum of 0° F. will cover most requirements. For class "B" oils, the pour test should also be applied, since it is essential that the consumer be protected against wax-bearing distillates. A maximum of 30° F. will be adequate for general conditions.

Distillation Range—A distillation requirement is necessary for class "A" oils to limit deliveries to the type of oil desired, and to insure proper fluidity and volatility. Only 10% and 90% points need be specified, the former to insure the proper amount of readily volatile material, and the latter to protect against excessive amounts of high boiling constituents.

Viscosity—For class "A" oils no viscosity requirement is necessary, since a distillation range clause will insure proper fluidity. For Class "B" oils a maximum value only should be set. A limit of 75 sec. at 100° F., Saybolt Universal, is suggested.

Carbon Residue—When the distillation range clause for class "A" oils properly is drawn, no carbon residue requirement is necessary. For class "B" oils, a carbon residue requirement generally is unnecessary, but it may be included where the oil is intended for use in types of burners which are sensitive to excessive amounts of this material.

Gravity—The gravity of an oil is of value only as an indirect and frequently unreliable indicator of other characteristics. These forms of specifications are so drawn as to make gravity requirements unnecessary.

Color and Odor—Color has no bearing on the quality of the oil for the purpose in question. Oils of this class cannot be expected to be odorless, and as odor cannot be specified in terms of any measurable standard, it should not be included.

Calorific Value—While the calorific values of class "A" and "B" oils are, of course, the reason for their use, there can be no valid comparison made between oil and coal in this respect. Oils are 100% combustible, and the calorific value of an oil of a given class is subject to but slight variation. A difference of 5° A.P.I. gravity generally will make a difference of not more than 2% B.T.U. per gal.

Sulphur—A sulphur requirement is unnecessary from the standpoint of the consumer.

## Chicago Oil Burner Association Active

Established in what might be called a veritable hot-bed of oil-burner activities, the Chicago Oil Burner Association, Inc., furnishes an excellent example of the advantages that may accrue from such an organization. Naturally such a group becomes a potent force when impelled by the comparatively few men, who are its officers, and the constructive activities of the Chicago association bear out this thought. There has been issued a booklet, containing the constitution and by-laws, the membership list and the ordinances governing oil-burner installations in the city of Chicago. Officers of the association are: Lyle Straight, president; Russell D. Barnes, vice-president; Cliff W. Presdee, secretary-treasurer; Jerome J. Sladkey, counsel.

The standing committees are for entertainment, fire investigation, membership, members' complaints, ordinance, and standardization and publicity. An official seal has been adopted and members in good standing are privileged to use this shield on business stationery, advertisement literature, and in other approved ways. At the present time the association has as honorary members: J. M. Neale, Chicago Board of Underwriters; John Plant, Chicago Fire Prevention Bureau; E. J. Smith, Underwriters' Laboratories.

There are, as active members, 22 representatives of oil-burner manufacturers, and, as associate members, 42 from allied industries.

Another activity of this association has established five large outdoor sign boards at strategic points in the city. It is understood that this form of advertising probably will be extended in the near future.

## Overproduction of Oil Causes Prices to Drop

A nation-wide survey has shown that the reduction of fuel-oil prices, below those of 1926, ranges from ½–3½ cents per gal. due to overproduction of oil. This situation is reported by W. W. Williams, president of the Williams Institute of Heat Research, Bloomington, Ill., who states that a price reduction has taken place in 342 out of the 434 cities studied.

In the Chicago section the price reduction ranged from 1–1½ cents in 29 of the 35 cities in which the investigation was undertaken. The New York district, in which 34 cities were covered, showed a price reduction of from ½–2½ cents in 27 cities. Three out of five Canadian cities reported a reduction of 2¾ cents. In New England 27 out of 43 cities showed a reduction of 1 cent. The Indianapolis division, in 70 out of 90 cities, reported prices cut from ½–3¾ cents.

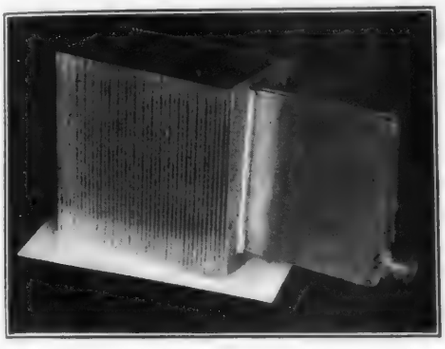
According to recent figures showing fuel oil stocks, it is easy to understand this downward trend in prices, since the first three months of 1927, as compared with the same period in 1926, shows an increased stock of 10,000,000 bbls.

**How Chicago Oil-Burner Dealers Unite to Sell the Advantages of Oil Heat**

# New Apparatus and Appliances

## Herman Nelson Builds Light-Weight Unit Heater

In response to a persistent demand for a light, compact unit heater that will withstand continuous heating service without developing leaks, the Herman Nelson Corp., Moline, Ill., announces a unit that has been given the trade-name hiJet. This is a wedge-core radiator of the extended-surface type, in which the steam-carrying element is a single casting of special non-ferrous metal. The extended-surface plates are firmly wedged to the core and keyed in position. The resulting unit offers a clean, clear steam-way and an almost unbreakable fin surface. The unit heaters are built-up of these wedge-core radiators, manifolded together and mounted in a suitable housing. They are assembled in three sizes, with proper motor-driven four-blade fans. Multiple deflectors are fitted to the units, and temperature control is possible over a wide range. Details of design and construction and all salient data are given in a special catalog just issued.



**A Single-Casting Core With Pressed-On Extended Surface**

**Light-Weight Herman Nelson Unit Heater**

## Mechanical Stoker for Domestic Heating Plants

Through the use of a revolving grate, driven by a small electric motor, and fired with coal from a hopper, the Wedge mechanical furnace is designed to make available to the home-owner the smaller sizes of coal that usually can be bought at a fraction of the cost of ordinary furnace sizes. The equipment consists of a conventional combustion chamber and sections of the round-boiler type, set upon a special revolving-grate section, which also incorporates the ash-pit. Below all is a circular casing containing the motor.

Coal is hand-fed to the hopper, which holds supply for 24 hours or more. Through the action of the motor, the fuel is slowly fed to the revolving grate, in proportion to the demand upon the system. This equipment is manufactured by Wedge Furnace Co., Paoli, Pa.

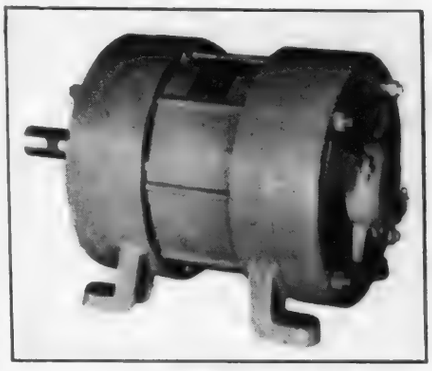
## All-Steel Line of Ball-Bearing Induction Motors

A line of all-steel, ball-bearing, polyphase induction motors, ranging in size from 1 to 100 H.P. in all standard voltages and cycles, is announced by The Lincoln Electric Co., Cleveland, O. This type of motor is representative of the new designs of equipment being brought out by this company, in which gray-iron and malleable castings have been entirely replaced by hot rolled steel.

It is claimed that every part of the motor is at least twice as strong as the former type which was built with a cast-iron frame. An example of the increase in strength of the frame is cited in the case of the motor feet. Drop-forged steel feet are welded on to the hot rolled steel end rings of the motor. This, it is claimed, eliminates a common source of difficulty with electric motors arising from the fact that cast-iron feet frequently are broken off in rough handling. The end brackets or bearing supports also are made up of welded steel construction giving a complete all-steel motor.

Economies in manufacturing by the new process, it is stated, have permitted the use of larger shafts and bearings than are usually found on this type of equipment.

Owing to the greater strength of steel as compared with cast-iron, less thickness of metal is required in the frame. It is claimed that the increased ventilation so obtained results in a considerable increase in the overload capacity of the motor, so that a continuous overload of from 10% to 50% can be handled by the motors, depending upon the size and speed.



**Lincoln All-Steel Ball-Bearing Motor**

## Burnham Announces 36-In. Swas-Teeka Boiler

A new tube-type steam and water boiler with 36-in. grates, and a trade name Swas-Teeka, has been brought out by the Burnham Boiler Corp., Irvington, N. Y. This type is designed to have a quick pick-up, and to operate on 30 lbs. water pressure and 15 lbs. as a steam boiler. It is tested at 45 lbs. for the former service and 75 lbs. for steam. The grates are double-trussed, ridge-shaped, and are in two sections for easy shaking. Short tie-bolts are used, making it easy to add sections. This series boiler is assembled in 6 to 14 sections, with capacities ranging from 3200 sq. ft. to 8400 sq. ft.

## Automatic, Weatherproof Fan-Ventilator

A novel method of ventilating a room is provided by the Nu-Air self-operating and self-closing ventilator announced by Paul & Beekman Mfg. Co., Philadelphia, Pa. This mechanism is an electric fan which, when the switch is turned on, moves axially, opening a circular shutter that automatically is closed when the fan stops, preventing dirt or rain from

**Easily Inserted Ventilator for Kitchen or Laundry**

entering. The installation consists in simply putting the fan into the top of the window opening; the expansion slide is then extended to close the opening, and fastened to the window frame. The fan can be attached to any nearby wall-outlet or lamp socket. The motor is encased to make it dust and moisture-proof, and it thereby is protected against grease, grit, dust or other substances that the fan may pull from the room. The motor is furnished for 110-volt alternating current or direct current.

## Clearing the Air of Dust with the Sirocco Collector

Cinder and dust elimination from the air is the function of the Sirocco collector, recently announced by the American Blower Co., Detroit, Mich. Plants using pulverized coal, where a large percentage of coal dust and fly-ash will seep through a 325-mesh screen, can be equipped to collect soot discharged from the boilers, that otherwise would pollute the atmosphere.

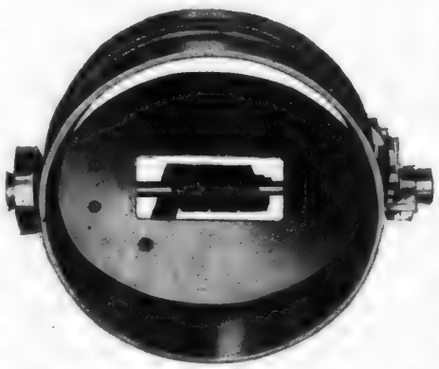
Type D collector, as it is called, consists of a main casing of volute shape provided with an inlet through which the dust-laden air or gas enters tangentially. Beneath the volute is arranged a series of alternating truncated cones and cylinders, terminating in a dust outlet at the bottom. The clean air or gas emerges from a central opening in the top of the main casing, or through this opening into a scroll-shaped outlet head.

The dust-laden air or gas, entering the collector tangentially, is forced, by its velocity, to take a path following the peripheral shape of the volute. Dust particles being heavier than air or gas are forced outwards against the periphery, and as the action of separation is centrifugal, the separating effect increases as the radius of the volute decreases. Besides moving centrifugally outwards, the dust is forced downward, partly by gravity and partly by the conical formation at the bottom of the casing. It leaves the volute in a downward direction, following a spiral path which is directed by the alternating truncated cones and cylinders to the dust outlet at the bottom. The cleaned air or gas forms a vortex in the center of the collector and passes upward through the outlet. The base of the vortex is formed immediately above the dust outlet, where suction takes place. Immediately beyond and below the vortex the concentrated dust, still following its spiral path, is forced out and downward, and any in-leakage, if the dust receptacle were open, would interrupt the flow and divert the dust into the vortex. By this process a cyclonic action is created without internal turbulence.

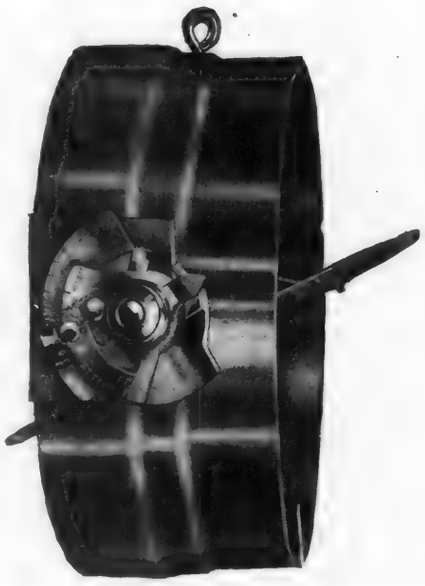
**This Huge Dust Collector Uses A Sirocco Fan**

## Automatic Damper Operates on Stack Temperature

Announcement is made by Preferred Utilities Manufacturing Corp., New York, of an automatic damper, actuated by stack temperature, which automatically closes to check the draft to the desired point. Starting with the damper open to desired degree, a coil of thermostatic metal rotates the damper plate, closing it with heat, and opening it as the stack gases cool. Adjustable regulating stops on the outside of the damper are designed to be set both for a maximum opening on cooling, and a maximum closing under heat, so that when the burner is in operation the damper will automatically cut down the draft, or reopen the pipe to provide the proper draft conditions. Normally the damper starts to close at about 150°, and closes to its minimum draft position at a temperature of about 325°, when it starts to reopen. The position of the arrow-shaped member which travels between the limiting stops, shows the position of the damper plate, as it is in the same plane. A relief spring precludes the possibility of distorting the thermostatic coil. The shaft and thermostatic helix of the damper are made of special metals to withstand high heats.



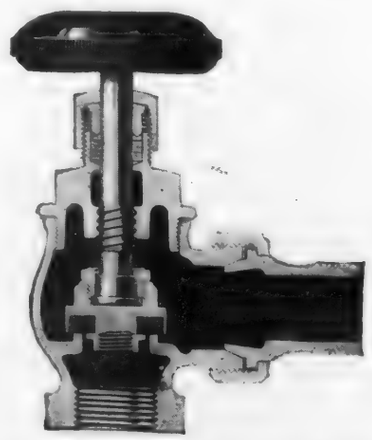
**Heat of the Flue Gases Twists the Shaft, Closing the Damper to a Set Point**



**Preferred Utilities Automatic Damper**

## Jenkins Offers Low-Bonnet Radiator Valve

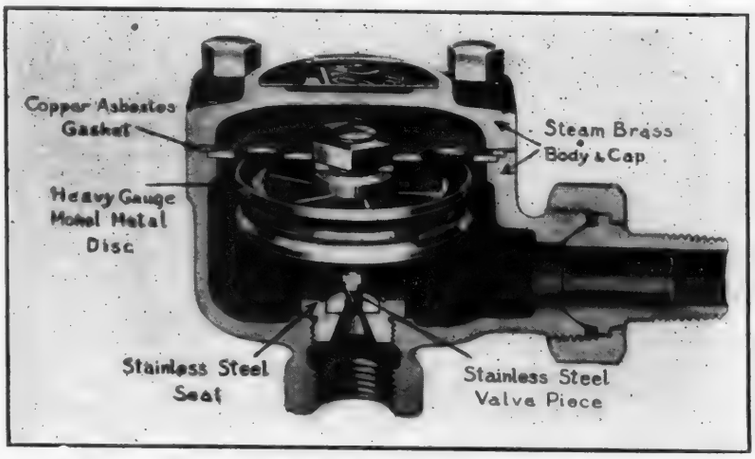
Another type of radiator valve has been announced by Jenkins Bros., New York. The body of the valve is of the same style as the regular radiator valve manufactured by this company, but the design differs in having a low bonnet which makes a low compact valve. Besides the standard pattern, these valves are produced in various other styles, such as globe, angle, offset, and globe-and-corner. The last mentioned is made in regular straight or offset pattern, right- or left-hand. Spindles are of manganese bronze, with double threads, the valve opening full with a single turn of the stem.



**Jenkins Low-Bonnet Radiator Valve, Angle with Union**

## Webster Equipment for Process-Steam Lines

Announcement is made in a bulletin being distributed by Warren Webster & Co., Camden, N. J., of a thermostatic trap designed for process steam applications. This bulletin discusses in detail the construction and performance of the Webster series 78 thermostatic traps, used to secure efficient steam circulation at the process pressures of from 10 to 100 lbs., the capacity of the trap decreasing with pressures. It is stated that air removal has been found to be the crux of the problem of process-steam distribution. Air comes from two sources; either through leakage, filling the steam compartments when the air is cold, or it is carried over in mixture with steam from the source of supply. There is also another problem, it is pointed out, besides air, which has to be met in obtaining free and economical circulation—the complete discharge of water of condensation. A description and detailed illustrations also give complete information about Webster series 78 dirt strainers.


Copper Asbestos Gasket
Steam Brass Body & Cap
Heavy Gauge Monel Metal Disc
Stainless Steel Seat
Stainless Steel Valve Piece

**Webster Thermostatic Trap for Process Steam Pressures**

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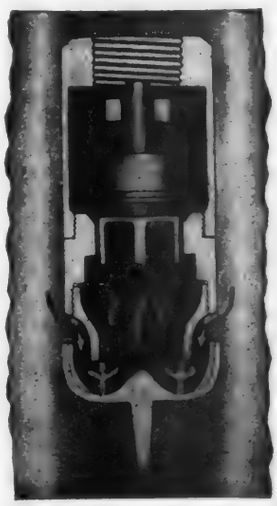
## Foot Valve Designed to Prevent Dirt from Entering Suction Pipe

A foot valve with a down-flow deflector, as a means of keeping the suction line from an oil-storage tank free from dirt, is being marketed by Preferred Utilities Corp., New York. Oil taken into the valve is sucked downward from that part of the tank contents well above the bottom of the tank. A pocket receives the sediment that collects in the foot valve, and this residue is washed out by incoming oil. After passing the deflector, the oil is drawn through a screen before it reaches the foot valve, which is provided with a conical seat of self-seating composition, assuring tightness. The Preferred foot valve with down-flow deflector is manufactured in ¼-in., ⅜-in., ½-in., and 1-in. sizes.



**A Foot Valve With Novel Features**

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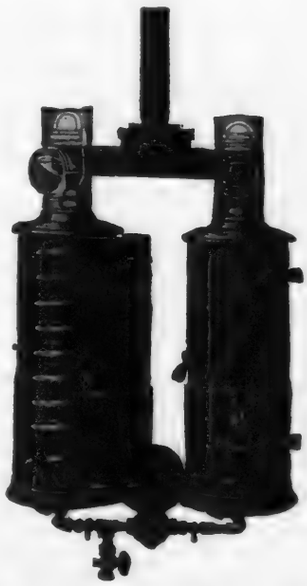
## "Twin 80"—A New Heavy-Duty Water Heater

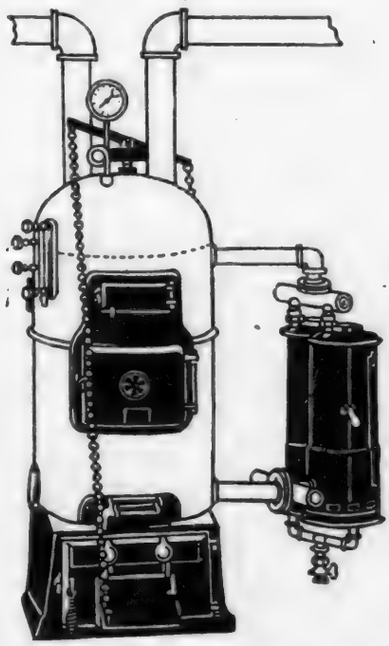
To meet the requirements of heavy-duty hot water storage jobs and as an auxiliary for steam, vapor or water heating plants, the Hotstream Heater Co., Cleveland, O., has developed a triple-coil water heater which may be used for a variety of purposes. As an auxiliary to either steam, vapor or hot water jobs the "Twin 80," as it is called, can be operated either independently, or simultaneously with these systems, thus making it possible to use either coal or gas, or both at the same time. The auxiliary is connected directly to the heating plant. For heavy-duty storage jobs a Hotstream thermostat is located in the lower manifold and can be supplied so that either one or both heaters are controlled by the thermostat.



**Hotstream "Twin 80" Heavy Duty, Triple Copper Coil Heater**

For hot water jobs the thermostat is placed in the upper manifold to prevent overheating. For steam or vapor jobs, no thermostat is required. For use as a home or apartment heater, either one or both units can be controlled by the usual heat regulator placed in the room. Where additional capacity is required the "Twin-80" may be used in batteries, connections being provided in the manifold for adding additional heaters.

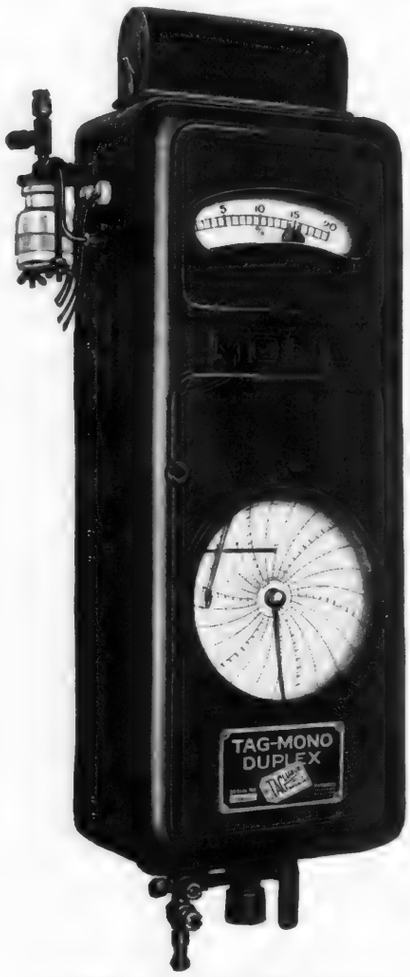
As the heater is of the instantaneous type, the manufacturers point out that when used for large domestic service supply, it is advisable to install an automatic storage tank. In that case the temperature of the stored water is maintained by a Hotstream thermostat located in the lower manifold. The heater's capacity, on storage tank, is given as 200 gal. and the radiation capacity as 500 sq. ft.



**A New Water-Heater—the "Twin 80"**

## New Tag-Mono CO and $CO_2$ Indicator-Recorder

An instrument for the simultaneous indication and recording of CO and $CO_2$ in flue-gas has been placed upon the market by C. J. Tagliabue Mfg. Co., Brooklyn, N. Y., under the name of Tag-Mono indicator-recorder. This instrument, which is referred to as the culmination of twenty years of instrument building, provides instantaneous readings of CO and $CO_2$ with red and black




**Tag-Mono CO and $CO_2$ Indicator-Recorder**

pointers and records variations in these gases on a standard circular chart. A similar instrument is made to record only $CO_2$. The duplex instrument is in itself a mechanical Orsat, automatically taking samples of gas from the flue, analyzing them for $CO_2$ and for combustible gases, both indicating and recording the results.

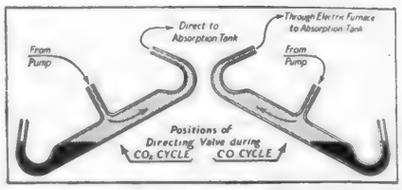
Two main parts and a separate power unit compose the Tag-Mono instrument. In the power unit there is an electric motor driving a centrifugal pump and a suction fan. The pump supplies the instrument with potash solution at a constant pressure, while the fan draws a continuous supply of gas from the flue so that samples are taken with a minimum time-lag.

Principal parts of the instrument are as follows:

An orifice valve, governing the flow of the solution supplied at constant pressure by the power unit. This orifice is not adjustable, and the size usually furnished is such that thirty to forty analyses per hour are made and recorded by the instrument.

A mercury pump, operated by the solution pressure, draws a sample of gas into the instrument during its suction stroke and then sends the sample, during its pressure stroke, through the instrument for analysis. A definite portion of this gas for analysis is measured off by the volumeter.

Gas from the intake line is admitted through a pressure seal during the suction stroke of the mercury pump. The pump is sealed against the admission of gas during the pressure stroke. There is water above the mercury in this seal, so that it also acts as a humidifier and all gas samples are saturated. A suction seal allows the gas samples to pass to the absorption tank during the pressure stroke, but seals against any return flow of gas or admission of air during the suction stroke. The mercury-operated directing valve determines




**Details of Operation of Gas Valve in Tag-Mono Indicator-Recorder**

the course of the gas samples after leaving the volumeter. It directs the samples alternately over two paths to the absorption tank; one path direct, and the other path through electric furnace which converts to $CO_2$ any CO which may be present in the samples passing through it and converts other combustibles, such as $CH_4$ and $H_2$ to $CO_2$ and water.

Caustic potash (KOH) solution which is contained in the absorption tank absorbs the $CO_2$ from the gas samples passing through it, the gasometer receives the residual gases of the measured samples after the $CO_2$ has been absorbed, and the floating measuring bell rises in proportion to their volume. The indicating and recording mechanism is actuated by the movement of this measuring bell.

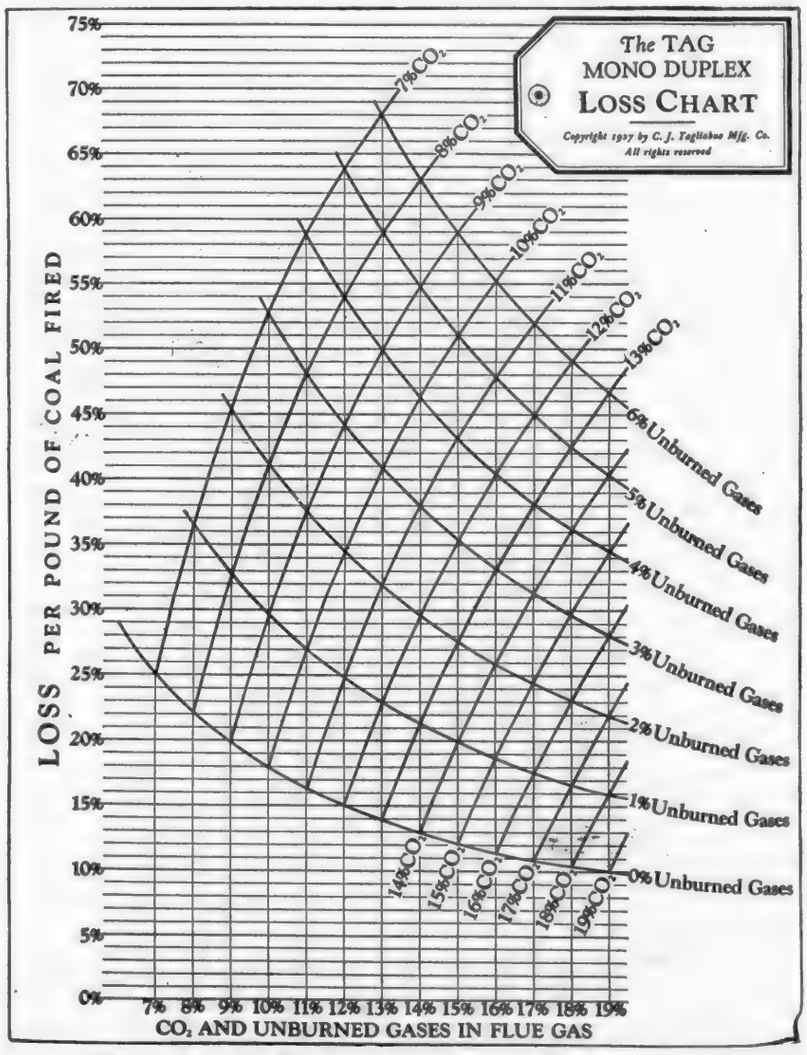


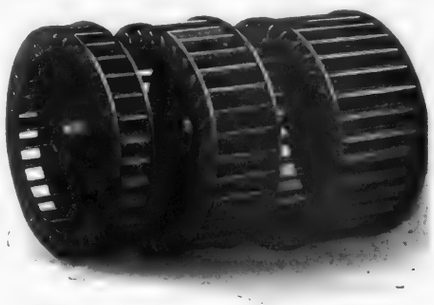

**Chart Showing Chimney Losses Due to Unburned Gases**

# New Trade Publications

CRESCENT CORK COVERING FOR COLD PIPE LINES, the latest product of the United CORK CO., Lyndhurst, N. J., is presented in a folder just issued by the Company. It is manufactured of granulated cork, compressed and molded in sectional forms, to fit the various sizes of pipe, and the fitting covers are molded to conform to the shape and size of the various fittings in ordinary use. It is finished with a coating of mineral rubber that provides a waterproof covering for all lines and fittings.

The covering is manufactured in three thicknesses: Standard brine thickness, for lines where the refrigerant ranges from 0° F. to 25° F.; ice water thickness, for lines where temperatures of 25° F. and higher are carried, and special heavy brine thickness, for lines where the refrigerant ranges below 0° F.

SIROCCO BLOWERS FOR OIL BURNERS are described in Bulletin No. 1033 issued by the American Blower Co., Detroit, Mich. The rapid growth of the oil-burner industry has caused this company to develop a special line of Sirocco wheels for this application. These



**Sirocco Runners for Oil-Burner Blowers**

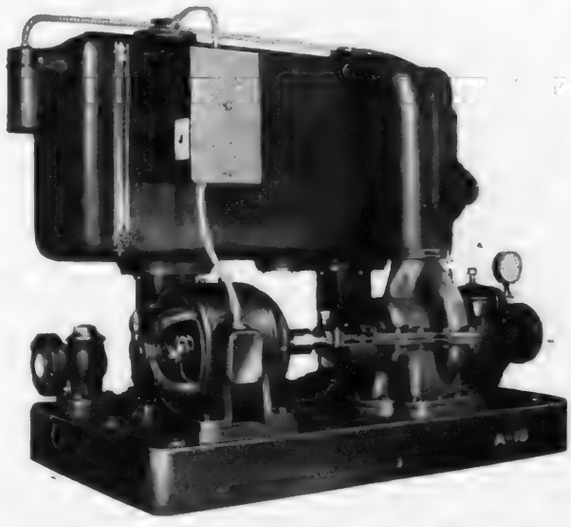
wheels are made in one piece with hub welded in place. It therefore is impossible for the wheels to break apart, and a light weight results that is advantageous in minimizing the starting torque.

CONTROL EQUIPMENT OF MOTOR OPERATED REDUCING VALVES is described in bulletin 8-R issued by Schutte & Koerting Co., Philadelphia, Pa. This control has been brought out to provide for a relay-controlled reducing valve, in which the control mechanism can be located at considerable distance from the main valve. The system is employed for steam-power station extensions, for heating systems in manufacturing plants, and for installations where process or heating steam is obtained from a high-pressure header by means of reducing valves. The control panel is actuated by steam from the low-pressure main, and functions through a relay operating on the motor-driven reducing valve.

THE HOME COMFORTABLE is the title on the cover of an attractive catalog received from the International Heater Co., Utica, N. Y. Within are described and illustrated the International Economy boilers, which are characterized by the slogan, "less fuel—more heat." Several types of steam and water boilers, and various views of one type are featured, with text that specifies the qualities of this make of boiler. Tables indicate guaranteed ratings in radiation loads from 427 to 5600 sq. ft. for the rectangular, and 187 to 666 sq. ft. for the round style. Colored illustrations in the catalog show lateral cross sections, with the flame, accentuating the smokeless operation of the rectangular type, and the water circulation in the round type. Size 7½ in. x 10½ in. Pp. 24.

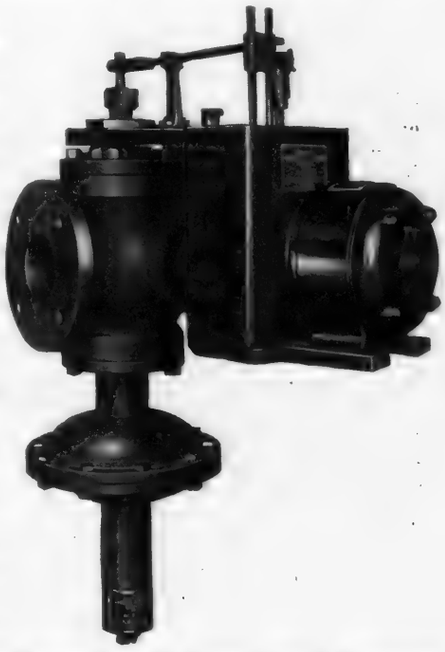
SHOP AND OFFICE TEMPERATURES styles a firmly bound catalog from the Powers Regulator Co., New York. The first part of the publication is devoted to a synopsis of ideal air conditions. Then follow testimonial letters, at the end of which is a list of the control equipment manufactured by this company. Size 8½ in. x 11 in. Pp. 52.

AMES VACUUM HEATING PUMPS are described in circular No. 51 issued by the Ames Pump Division, W. N. Best Corp., New York. These return-line vacuum pumps have been carefully worked out to perform their functions with a minimum of operation and maintenance. Pumps rated in this bulletin range, in water capacity from 22 to 140 gal. per min., on which basis they are designed for installations containing from 16,000 to 100,000 sq. ft. of direct equivalent cast-iron radiation.



**Ames Vacuum Pump for Heating Systems**

HORNUNG MASTER-CONTROL VALVES are described in Bulletin No. 18 issued by Central Heat Appliances, Chicago, Ill. This valve is designed for the automatic control of temperatures, pressures, fluid levels, etc., and consists of a valve actuated through worm-and-gear reduction by an electric motor which



**Master-Control Valve, Motor Operated from Distant Control**

may be thermostatically controlled to operate in any one of a number of ways. The circular is well-illustrated and contains engineering data on this type of valve.

KEWANEE FIREBOX BOILERS are the subject of an interesting catalog issued by Kewanee Boiler Co., Kewanee, Ill. The essence of claim for recognition of these boilers is contained in one paragraph in the foreword:

"Embodied in the design and construction of Kewanee boilers are these features, resulting from the application of modern engineering knowledge and research: The highest grade materials; substantial riveted joints; heavy stays and braces for flat surfaces; spacious fireboxes for the best combustion of any fuel; together with enough tubes of sufficient size and length to handle all the flue gases effectively, and these tubes are so arranged in relation to each other and to the boiler shell as to allow free circulation of water; also there is proportionate heating surface and grate area; ample steam space to insure dry steam, and a water content sufficient to hold the water line steady."

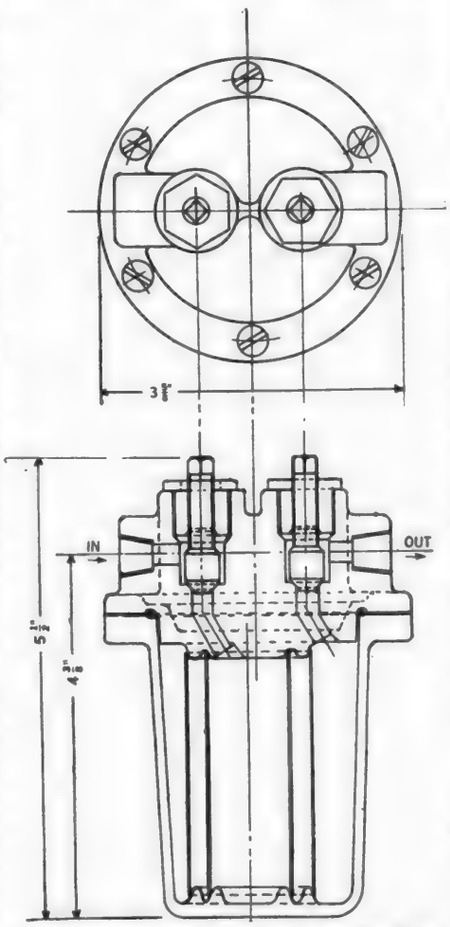
The catalog contains all essential data, with several blueprint pages of setting measurements. Both the brick set and portable types are shown, as also is the special down-draft type for oil burning. Size 6 in. x 9 in. Pp. 52.

SPECIALTIES FOR STEAM, WATER, AIR, GAS AND OIL is the title on the cover of Catalog No. 57 recently issued by Kieley & Mueller, Inc., New York. The products described are designed for heating and plumbing systems, power plants and gas and oil-field installations. A general index at the beginning lists alphabetically all the products mentioned in this attractive and well-bound catalog. On the following pages appears a figure index, making it also possible to locate the products by number. In the middle of the book are found instructions for connecting and installing a damper regulator, followed by data on several types of these devices. Further on is a description of the installation and operation of Kieley triple-duty emergency-stop and check valves. In the back is printed a schedule of standard and extra-heavy flanges, and tables of sizes and prices of diaphragms. The last five pages are left blank, as a memorandum convenience for anyone utilizing this easily handled book. Each product is described and illustrated, usually in a diagrammatical form, to show the separate parts of the device. Tables giving prices, dimensions, and weights accompany practically every illustrated product. Size 6¼ in. x 9¼ in. Pp. 232.

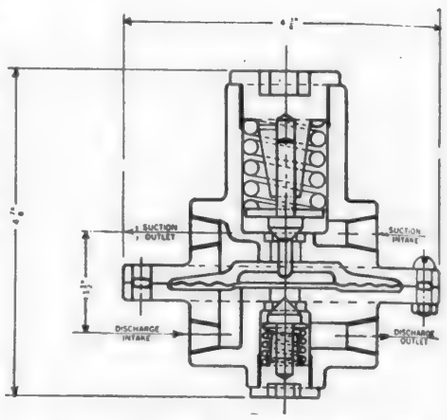
THE NOKOL NEWS for June features a story on the Oil Heating Institute's Education and Publicity Campaign. Another article deals with the present changing oil situation, in which attention is called to the desirability of burning light oil of the "furnace oil" type. Another article quotes at length from a confidential pamphlet prepared by *The American Architect*, containing the results of a survey among its readers for the purpose of determining their attitude toward oil burning. A number of interesting secondary articles also appear in this bulletin.

OIL-BURNER EQUIPMENT is the title of an attractive loose-leaf catalog being distributed by the Grant Accessories Corp., New York. Various specialized products are herein described and illustrated, such as automatic shut-off valves, double-basket oil strainers, several types of motor-driven, low-pressure blowers, and packless pumps. One page of the book is devoted, in turn, to each of these items, and on the reverse side of the page appears a diagram showing the construction and dimensional details of the product. The automatic shut-off valve closes both the suction and return lines of the pump, which is kept continuously primed. It also acts as an anti-siphon valve. The controlling diaphragm has a surface of 17 sq. in., and when the pump action is applied to the top of the diaphragm, and the discharge from the pump to the bottom of the diaphragm, the forces are so multiplied, it is pointed out, that the extremely low suction produces positive action. It is stated that the suction side of the valve closes with 50 lbs. pressure, and the return side with 5 lbs. pressure. The interior is lined with phosphor bronze to prevent corrosion. Size 9 in. x 11½ in. Pp. 16.

Grant Oil Strainer




Section of Grant Double-Basket Oil Strainer




Section of Grant Automatic Shut-Off Valve

HOME VS. HOUSE is the title given a booklet received from the Preferred Utilities Co., New York. In descriptive manner a colorful picture is drawn of a comfortable home in which the oil burner is featured as a definite asset. A story is written about the Ray fuel oil burner, pointing out its salient advantages.

CENTURY DOUBLE SQUIRREL-CAGE MOTORS, AND SPLIT-PHASE INDUCTION MOTORS are separately described in four-page pamphlets being circulated by the Century Electric Co., St. Louis, Mo. Assembly of Century Repulsion-Start Induction Single-Phase Motors is outlined in another leaflet by the same company. Within the cover is a double-page display of the essentials of these motors. Emphasis is particularly stressed on their design and construction. By methods of lubrication used with these motors, it is pointed out here, that at least one year's continuous 24-hour-per-day operation is assured without re-oiling. Other features mentioned are the brush-lifting mechanism and short-circuiting device which have been used for more than 23 years in these motors.

FOUR VERY IMPORTANT PRODUCTS is the caption of a loose-leaf folder issued by General Air Filters Corp., New York, devoted to Ace automatic self-cleaning air filters, Ace spray nozzles, Ace water-cooling equipment and Ace air washers. The data are arranged for handy use, the spray nozzle and air washer designs being shown in blueprint form, accompanied by dimension and capacity tables and a technical discussion dealing with the application of spray washers. The company's air filters are of the so-called dry type. The capacity rating of 800 cu. ft. for each cell and the average resistance figure of ¼ in. water gauge are based on the results secured in the company's laboratories, a typical testing machine being reproduced in the circular. Among the other interesting views are dry filter installations at 137 Duane Street and at 500 Madison Ave., New York. An effective series of page posters written by G. S. Dauphinee, the company's engineer, devoted to "Dust," discusses various features of the problem, different methods for removing dust from the air, using water sprays, mechanical means, electro magnets, electricity, straining and impingement against sticky surfaces, concluding with the adaptability of the company's air filters for this work. A clever idea is worked out in the headings for these sheets by using dust particles to form the caption, "Dust."

WHAT JANETTE POLICY MEANS TO SMALL MOTOR USERS is the title of a small folder being mailed by Janette Mfg. Co., Chicago. A number of pictures are used to show the production equipment in the Janette factory and one page shows several Janette motors for special adaptations, such as the oil burner, mechanical piano and addressograph.

ORGAN-CHAMBER HEATING FOR CHURCHES AND THEATRES is the subject of a bulletin issued by Buffalo Gas Radiator Corp., North Tonawanda, N. Y. In it is briefly described a thermostatically-controlled Niagara electric heater by which it is possible to maintain, in the organ chamber, the 70° temperature at which the pipes are voiced in the factory. Size 8½ in. x 11 in. Pp. 4.

WHAT PRICE COMFORT is the title of an attractive brochure sent out by the Tacoma Gas & Fuel Co., Tacoma, Wash. There is comparatively little text in the presentation of the story, which is largely pictorial. The copy has been well prepared, with no misleading statements or exaggerations, and the photographs tell the Tacoma people just what their neighbors are doing in house heating, with both warm air furnaces as well as with radiant gas-heaters in fireplaces.

PUTTING IDLE HEAT TO WORK is the title of a treatise on the heating of factories and similar enclosures bringing out the features of the York heat-diffusing unit, manufactured by the York Heating and Ventilating Corp., Philadelphia. As a foreword there is told the story of a factory so imperfectly heated that the operatives near the radiators were over-warm while those farthest from sources of heat suffered from the cold. The next chapter outlines the natural laws of physics that cause the movement of heated air. A third section tells the story of the basic principle of the York practice—that of horizontally jetting warmed air at high velocity so that it reaches the farthest confines of the room before the velocity energy is dissipated. The removal of the stratum of colder air along the floor, which is pulled to the intake of the heater, then causes the diffused warm air to fall and occupy that volume instead of rising. To give visual demonstration of the correctness of this theory there follow a number of drawings and photographs of smoke-bomb tests. Several pages are devoted to photographs of typical installations of York units in various types of plants and a list is given of thirty nationally-known organizations using them. Essential technical data follow. Size 8½ in. x 11 in. Pages 16.

RICHARDSON AIR AND VACUUM VALVES are described in a little folder being circulated by Richardson & Boynton Co., New York. These sylphon air and quick-vent valves have large air ports and channels, large float diaphragms, shells of hard-drawn, extra-heavy-gauge sheet brass and caps of solid brass rod. Each valve is individually put through a factory test before being packed for shipment and is guaranteed positively to separate air and condensate.

KEWANEE SLIM TYPE RADIATORS are featured in Catalog No. 83 received from Kewanee Boiler Co., Kewanee, Ill. This type has been developed to meet the demand for clean-cut radiators of high radiating surface for a given floor area, and with smooth undecorated surfaces. This type is made in 3, 4, 5, 6 and 7-tube sections, in heights from 14 in. to 38 in. The catalog pictures and dimensions all commercial combinations and a double-page blue-print gives roughing-in data. Details of construction and suitable brackets for all sizes are also featured. Size 6 in. x 9 in. Pp. 24.

Smoke Bomb Test of York Unit Heater, Showing High Velocity Jet From Delivery Nozzles

MCILVAINE OIL BURNER is described in a display folder issued by the McIlvaine Burner Corp., Chicago, Ill. This burner is a radical departure from the conventional practice of to-day, in that it provides for a continuous flame with graduated control, doing away with the gas pilot or other form of ignition. Temperature changes are caused by increasing or decreasing the combustion rate, by means of a needle-valve controlling the oil, and a graduated damper admitting more or less air. The two

Air Shutter and Oil Valve of McIlvaine Oil Burner, Showing Linkage for Maintaining Fixed Ratio of Oil and Air

controls are connected together with links, and accurate proportions of air and oil are insured at any setting after the burner is first adjusted. The circular is well-illustrated, and brings out the salient features of the unit.

ALADDIN OIL-BURNER, Models G and H, are featured in a circular received from Aladdin Utilities Corp., Chicago, Ill. These models are particularly designed for large horizontal boilers, and are of the "straight shot" type, for use with 28°-32° A.P.I. oil.

AEROLOGICAL INSTRUMENTS are described in a catalog received from the E. Vernon Hill Co., Chicago, Ill. Most of the equipment described in this catalog is highly specialized, and developed particularly for use in aerological work. Thermometers of the dry and wet-bulb type, psychrometers, dust counters, draft gauges, anemometers, and air-current apparatus of various kinds are listed and priced. Size 6 in. x 9 in. Pp. 34.

MERCOID CONTROLS FOR REFRIGERATION EQUIPMENT are described and illustrated in a catalog, issued by the Federal Gauge Co., Chicago. This equipment consists essentially of Mercoid controls which have been adapted especially to the needs of the refrigeration industry. Size 8½ in. x 11 in. Pp. 16.

MERCOID CONTROLS are described and illustrated in an attractive catalog issued by The Federal Gauge Co., Chicago, Ill. In addition to data presented on the old established Mercoid equipment, this catalog features the comparatively recent additions; the combination pressure control and low-water cut-off, the Visaflame Type L safety switch, the Adjustatherm Type S trip switch, the Type A safety overflow drip switch and the Type SA stack safety.

LOS ANGELES is the title of a circular received from the Pacific Steel Boiler Corp., Waukegan, Ill. Two Los Angeles high schools are pictured and the statement is made that 22 school buildings in that city and 11 more in nearby cities are heated by Pacific oil-fired boilers. It is pointed out that, as these boilers are fired from the rear, the products of combustion travel four times the length of the boiler before reaching the smoke pipe.

AMERICAN CORTO appears on the cover of an attractive catalog issued by American Radiator Co., New York. Two dainty color plates show this radiator at its best, and the presentation of data is carried out in a way that will appeal to the architect—for whose special benefit this catalog was issued. Over-all dimensions are given for all combinations, together with corresponding ratings.

DUNHAM MAGAZINE, published monthly by C. A. Dunham Co., Chicago, has leading articles devoted to the differential vacuum heating system, the last of these outlining the basic requirements for its efficient working. Pictures of buildings, in which installations have been made, are arranged attractively. Diagrams and graphs also illustrate special features of this particular heating system.

AEROPILE, a new floor ventilator for theatre, auditorium and church requirements, is described in a circular recently received from M. O. Kasson Co., Chicago. This ventilator embodies new ideas and design and, through key-operated shutters, controls the air volume without changing the discharge area. It is so shaped that when installed under theatre and similar seats, it will not discommode the occupants. Aeropile is easily and quickly installed and is so constructed as not to bend, break or rust.

**Aeropile Floor Ventilator**

HOW FAR CAN YOU READ IT? is the heading on the cover of a small folder from The Foxboro Co., Foxboro, Mass., in which is described and illustrated an indicating thermometer. Two sizes, the 5-in. and 8-in. dial, are mentioned together with a sketch of the appearance and mechanism of the product. In the center is a full-size picture of the standard 5-in. dial indicating thermometer. Operation of these thermometers depends upon the vaporization of

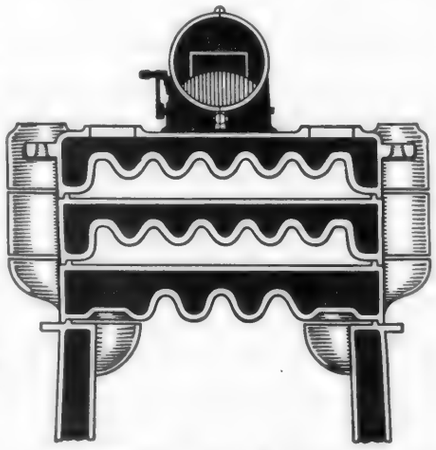
**An Easily-Read Indicating Thermometer**

a volatile liquid, or the direct expansion of an inert gas. The movement consists of a single Bourbon tube that expands or contracts with changes in temperature, and a rack-and-pinion device that multiplies the motion of the tube, transforms it into rotary motion, and transmits it to the pointer. Another bulletin No. 148 gives further details.

KLIPFEL VAPOR THERMOSTATS form the subject of Bulletin 127 received from Klipfel Mfg. Co., Chicago. These instruments are complete units for controlling steam flow, and are manufactured with valve sizes ranging from ½ in. to 8 in., and for corresponding steam pressures from 200 lbs. to 12 lbs. There is a semi-balanced bevel-seated bronze inner-valve, normally held open by a lever and weight or by a spring. The temperature-sensitive bulb is installed in contact with the medium—usually steam or water—which is to be controlled. An increase in the bulb temperature increases the pressure of the volatile liquid hermetically sealed in the bulb, and this pressure is transmitted through a tube to all-metal bellows in the valve. The expansion of the bellows operates the valve stem and inner valve. In order that a predetermined temperature may be maintained, the movement of the valve stem and inner valve is opposed by the lever and weight, or by the spring. When the desired maximum bulb temperature is reached, the semi-balanced inner valve seats and shuts off the flow of steam. As the temperature of the heated medium falls, the pressure acting on the bellows is reduced, the inner valve opens, and the cycle is repeated. Reverse-acting valves are available. The bulletin illustrates and describes the various types and their applications, and furnishes all essential data. Size 8½ in. x 11 in. Pp. 8.

HOFFMAN VALVES, CONTROLLED HEAT AND VAPOR EQUIPMENT heads a recent bulletin received from Hoffman Specialty Co., Inc., New York. Among the valves described are the siphon air valve, the siphon air and vacuum valve, the valve lock, the air line valve, the quick vent, the quick-vent float air and vacuum, adjustable modulating, Nos. 8, 9 and 18 return line valves, and various other products. Several types of equipment for controlled heat are mentioned. Illustrations and diagrams make the descriptions of these articles more explicit. Size 8½ in. x 11¾ in. Pp. 12.

ROUND AND SMOKELESS TYPES OF BOILERS are described in two catalogs received from Weil-McLain Co., Michigan City, Ind. The characteristics outlined in the description of the round boiler are the corrugated crown-sheet section, the corrugated surface carried throughout the boiler for effecting a larger heat-transfer area, and the long back-and-forth gas travel, eliminating short cuts to the chimney. Illustrations



**In Weil-McLain Round Boilers Corrugations Increase Heating Surface**

show the gas passage and heating-surface details. Tables are given of the steam and water sizes with their respective ratings, also of minimum chimney sizes. In the catalog on smokeless boilers the cause and prevention of smoke is briefly discussed. Four major points are sketched in connection with this type; longer firing periods without attention, simple firing, fuel adaptability, and an interchangeable arrangement for oil burning. A large illustration in the center of this catalog shows a cut-away view of a 13-section smokeless boiler in which the four principles above mentioned are depicted. Sizes, 8½ in. x 10½ in. Pp. 8 and 16, respectively.

POWERS TANK THERMOMETERS are described in a circular issued by Powers Regulator Co., Chicago. These thermometers, for insertion in tanks and pipes, are of the dial type with vertical or horizontal stem and, in addition to being accurate, emphasis is laid on the fact that they are easily read even under conditions of poor illumination.

# Oil Burners for Large Low-Pressure Heating Plants

## Best. *Air or Steam Atomizing Type, Gas Ignition, Automatic or Manual Control*

## 2. W. N. Best

The first article in this series was: 1. *Todd, August*, 1927.

FOUNDED thirty-six years ago by that Nestor of the oil-burning industry, Dr. William N. Best, and for many years confining its activities to marine and high-pressure stationary fields, the W. N. Best Corp., New York, is now firmly established as manufacturers of oil-burning equipment for large low-pressure installations.

A notable feature of this burner is the nozzle design. It was one of the tenets of Doctor Best that the shape of a flame should conform to the general plan of the combustion chamber; that a long deep boiler should be fired with a long flame, and that a boiler with a grate surface nearly square would show better performance if the flame were fan-shaped, and as broad as possible. In the final nozzle design, Doctor Best provided for adjustments to make possible this wide range in flame shape.

### TWO BURNER TYPES HANDLE ALL FUELS

It has been found necessary to design two types of burners in order to meet all fuel characteristics. These burners are called "low-pressure" and "high-pressure" types, not in regard to their utilization under low-pressure or high-pressure boilers, but from the pressure that is employed as the atomizing medium.

The "low-pressure" burner is designed for fuels of 24° A.P.I. and lighter, while the "high-pressure" type has been developed to handle the characteristic "Mex crudes" of 12°-14° gravity. As an example of the extreme to which this burner can go, it is stated that near-solid tar of 6°-8° gravity successfully can be fired.

Naturally, even where the cheapest fuel oil is available, it is desirable to use grades from 24°-28° when boiler capacities are small, as the saving that would result from the lower fuel cost probably would not offset the added complexities of an installation burning the lower grade fuel.

There are, however, many instances of low-pressure boiler installations so large that the cost of fuel is the important factor in the cost of steam. In such cases it is usually the policy of Best engineers to install the high-pressure burners for the cheapest available fuel, putting in a small auxiliary boiler to supply high-pressure steam to the nozzles.

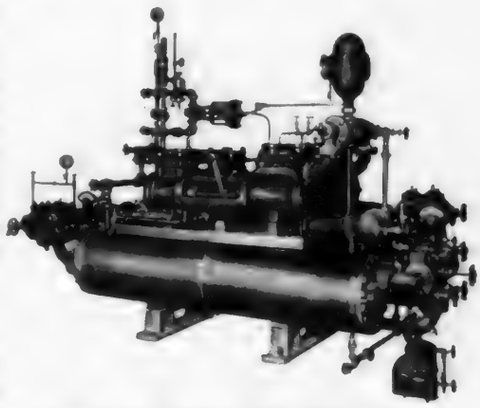
### THE LOW-PRESSURE BURNER

Air-pressure exclusively is used for atomization in the low-pressure type, largely because of the comparative ease of producing a uniform supply of air at 20-24 oz. pressure.

Various combinations of motor, blower and oil pumps are used, dependent upon the characteristics of the job. Connersville blowers, direct-driven, Leiman and Viking pumps and Spencer direct-driven turbo-compressors are used according to requirements. Because of the direct course of the oil through the nozzle, atomization is accomplished with pressures of 1 lb. or less. Air chambers are used, where necessary, to offset any pump pulsations.

### CONTROLLING THE FLAME SHAPE

Oil from the pump passes through a manually regulated valve before entering the nozzle. Air comes to the nozzle through a 1-in. to 3-in. pipe, and is ejected in a horizontal sheet at comparatively low velocity. The width of this fan-like air jet is adjustable through the shaping of the sides of the air nozzle. This adaptability to long, narrow boilers, as well as to almost square types, always has been one of the characteristics of burners designed by Doctor Best. The oil passage in the burner is in the shape of an elbow, and the oil is ejected down onto the flattened air jet, completing the process of tearing the oil apart which is begun by the oil nozzle. A vertically-sliding gate valve, adjusted by means of a hand wheel, provides for air volume regulation.



**A Duplicate Pump Set Provides Against Breakdown of Heating Service**

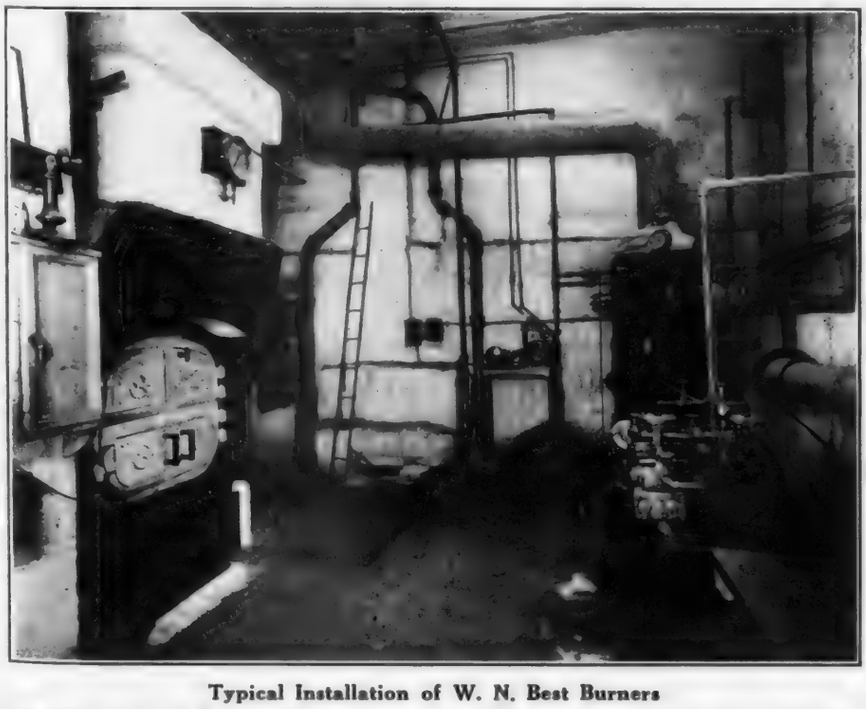
### IGNITION AND CONTROL

A gas pilot, properly located, is used to insure continuous ignition. Electrical ignition has been tried, but ultimately was discarded in favor of gas.

Where fuel lighter than 28° A.P.I. is to be used, Honeywell automatic control equipment will be installed. Where only heavy fuel is to be burned manual control and adjustment are provided. In the latter case the assumption is that an attendant is constantly available.

### SAFETY DEVICES

An automatic air-relief valve is connected to the air delivery pipe; also a simple automatic air-operated cut-out valve is provided to stop the flow of oil



**Typical Installation of W. N. Best Burners**

The boiler at the left is fired from the rear, hence the burner is not visible. The small vertical boiler generates steam for the burner when starting up the main boiler.

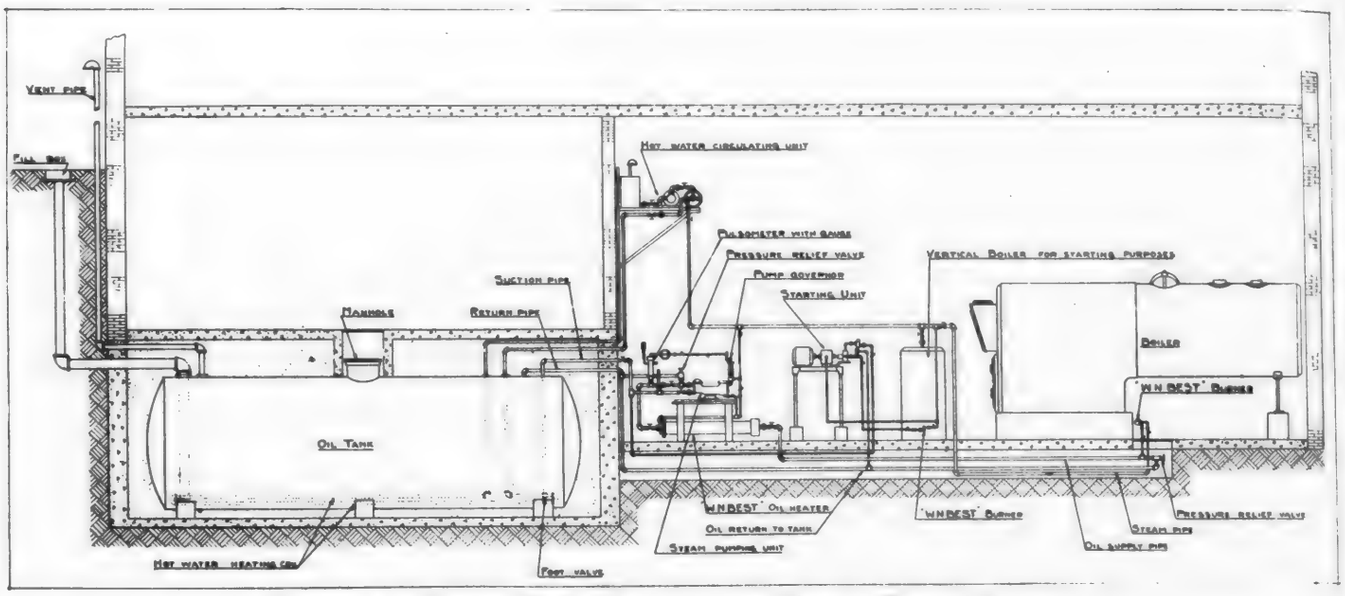



**Diagram of a Typical W. N. Best Installation, Showing Essential Features**

in case the air flow fails. A pressure-relief valve is located in the oil line, so that stoppage at the manual oil-control will cause the relief to open and return the oil to the tank. A stack safety may be installed to shut off the oil in case the flue temperature falls below a designated point.

### OIL HEATERS

Where oil fuel below 24° A.P.I. is to be burned, it is necessary to provide for pre-heating the oil before it reaches the burner. Such heaters usually are of the hot-water type, and are manufactured by the Best Corporation.

### RATINGS

Low-pressure burners are built in three sizes, rated as follows:

| Burner No. | Fuel Capacity Gallons | Per Hour Pounds |
|---|---|---|
| 5 | 0.25—10 | 2— 80 |
| 6 | 0.50—15 | 4—120 |
| 6½ | 0.75—20 | 6—160 |

### HIGH-PRESSURE BURNERS

As previously stated, the high-pressure and low-pressure burners are not installed for high-pressure and low-pressure steam production, respectively, but the former is designed where heavy oils, even down to tars, are to be burned. Such an installation, in New York, consists of a pair of Kewanee boilers, rated at 150 H.P. each, generating steam at ½ lb. to 2 lb. pressure. These boilers are fired by Best high-pressure burners, taking steam from a small auxiliary vertical-tubular boiler of 10 H.P. rating. This small boiler is equipped with two burners, a high-pressure and a low-pressure type. For initial starting purposes this boiler is fired-up with the latter burner, which is provided with a separate air and oil pump. This burner uses 28° oil. When a steam-pressure of 30 lbs. has been reached, the high-pressure burners under the Kewanee boilers can be started with the regular 14° oil, and the high-pressure burner under the small boiler is started, so that the entire plant is burning the 14° oil. During the summer season when the heating plant is not used, steam is maintained on the small boiler for heating the service water for the building.

### HIGH-PRESSURE BURNER RATINGS

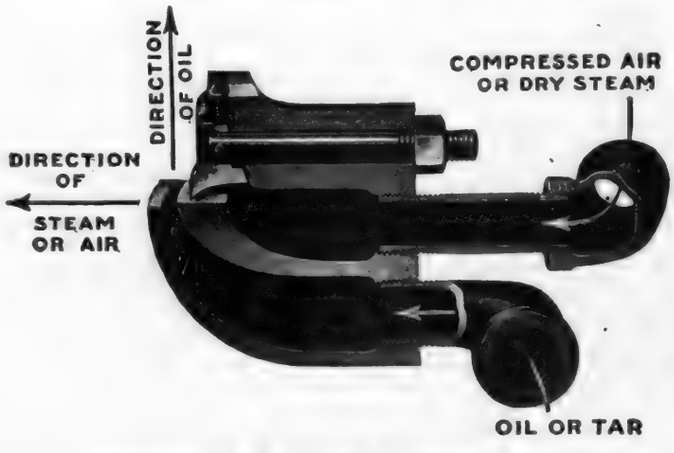
There are five sizes of high-pressure burners, rated as follows:

| Burner No. | Fuel Capacity Gal. Per Hour | For Boiler Horse Power |
|---|---|---|
| 0000 | 0.08—4 | — |
| 000 | 0.25—6 | — |
| 0 | 0.50—15 | 5—15 |
| 1 | 1.50—34 | 16—100 |
| 2 | 3.00—166 | 101—500 |

### TYPICAL INSTALLATIONS

Many notable installations have been put in by the Best Corporation during its comparatively long existence. Naturally, the larger number are in big industrial and commercial plants, where high-pressure steam is generated. Outstanding instances of low-pressure jobs are those at Princeton University; and such plants in New York as the Bowling Green office building at 11 Broadway, the School of the Immaculate Conception and Manhattan College.

It is not strange that the Best organization is proud of the record made at the Pacific Mills, Lowell, Mass., where 42-150 H.P. oil-fired boilers have been practically in continuous service for 11 years. During this entire period, when the actual and relative costs of coal and oil have fluctuated over a wide gamut, the management has not once seen fit to revert to solid fuel.




**Section of W. N. Best High-Pressure Burner for Heavy Fuels**

**Low-Pressure W. N. Best Burner for Fuels of 24° A.P.I. Gravity and Lighter**

DEXTER HORTON NATIONAL BANK BUILDING
SEATTLE, WASHINGTON

*Architect*: John Graham, Seattle
*Consulting Engineer and Heating Contractor*: Hugh Phelps, Seattle
*Building Manager*: Charles E. Horton

# Powers Control
## *Costs Less in the Long Run*

Annual bills for repairs and adjustments of temperature control will have no place in the budget of the Dexter Horton National Bank, of Seattle. Architect, Consulting Engineer, and Building Manager joined in eliminating that needless expense. They installed the POWERS system of Automatic Temperature Control. Realizing that "first cost" is only a relative factor, they figured the "upkeep" as well, for experience shows that the POWERS trouble-free system insures from 20 to 30 years of accurate and dependable control, without the need of frequent adjustment or the constant expense of "service".

For convincing evidence to support the above claims, read our book, "The Elimination of Heat Waste". Sent free on request.

**The Powers VAPOR DISC Thermostat**

This remarkable thermostat gives *absolute* graduated control, uses but 10% of the compressed air required by other systems. Good for 20 to 30 years of *accurate, dependable* control, without frequent repairs or adjustments.

# THE POWERS REGULATOR CO.

***36 years of specialization in temperature control***

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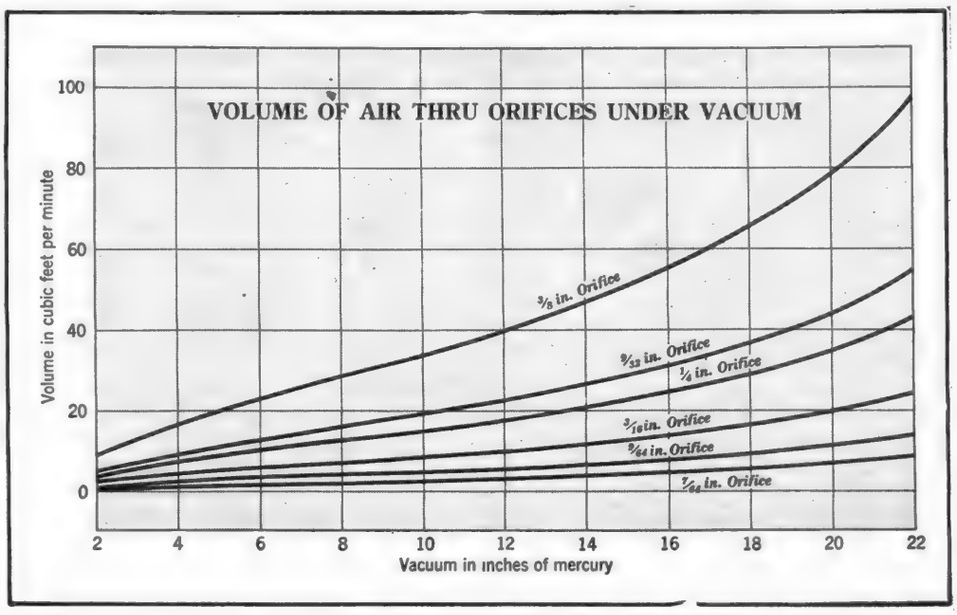


*Chart showing the volume of air flowing through specified orifices under vacua such as exist in heating pump service.*

# Jennings air capacity is quantitatively measured —*not guessed*

When you install a Jennings Vacuum Pump in a return line steam heating system, you can do so with confidence that the Jennings Pump can be depended on to remove the specified amount of condensation and air for which it is rated.

Take Jennings air capacity, for example. This is quantitatively determined for each pump before it leaves the factory, by means of the specified vacuum which the pump is able to maintain through a thin plate orifice, 1/8 in. thick, with sharp edges and aperture of given diameter.

**NASH ENGINEERING COMPANY**

**81 WILSON ROAD** **SO. NORWALK, CONN.**

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# *Jennings Pumps*

**RETURN LINE AND AIR LINE VACUUM PUMPS CONDENSATION AND CIRCULATING PUMPS**

# Trade and Miscellaneous Notes

## Coming Events

**September 19-23, 1927.** Fall meeting of the American Welding Society at Detroit, Mich. Headquarters at the Book-Cadillac Hotel.

**September 26-Oct. 1, 1927.** Eleventh Exposition of Chemical Industries at New York. Headquarters at Grand Central Palace.

**October 10-13, 1927.** First National Fuels Meeting of the American Society of Mechanical Engineers at St. Louis, Mo. Headquarters at the Statler Hotel.

**October 10-14, 1927.** Ninth annual convention of the American Gas Association at Chicago, Ill. Headquarters at the Hotel Stevens.

**October 17-21, 1927.** Fifty-sixth annual convention of the American Public Health Association at Cincinnati, O.

## Miscellaneous Notes

**Building Operations for July, 1927,** as reported by the F. W. Dodge Corporation, showed an increase of 3% over 1926. The figures for 37 States are $534,399,900. Of this amount 35% was for residential buildings; 27% was for public works and utilities; 16% for commercial buildings; 7% for educational buildings, and 6% for industrial buildings.

**H. W. Sweatt,** vice-president of the Minneapolis Heat Regulator Co., Minneapolis, Minn., is spending a month in Europe.

**Heating and Piping Contractors' Milwaukee Association,** in conjunction with the supply men of that city, held their annual outing August 2, at Hilgen Spring Park, Cedarburg, Wis. Over 200 members and guests were present at this all-day picnic. The committee in charge of arrangements was R. J. Kellerman, Allen Pflugradt, Fred Cordes, Frank Glas, Fred Dannies, Edwin Gapinsky and William Zacharias.

**David B. Roberts,** president and treasurer of the Super Oil Heator Co., Hartford, Conn., and his son Harry B. Roberts, vice-president, are retiring from the automobile agency business with which they have been identified for many years, and will devote their entire time to the Super Oil Heator Company. The manufacturing plant at present is in Pawtucket, R. I., but it is stated that a plant may be erected in or near Hartford to take care of the increased demand for oil heaters.

**New York Oil Burner Dealers' Association** held a meeting July 21. This organization has newly been formed, and those eligible for membership are representatives in the eastern area of oil-burner manufacturers. One of the provisions made is that all executives and salesmen of companies can be members, but only one man from each organization will have the privilege of a vote. Officers are: President, F. F. Lewis; treasurer, A. Vaerenklau; secretary, J. S. Kaplan, of the Preferred Utilities Company. Board of governors: F. F. Lewis, N. J. Sage, L. D. Angell, J. S. Kaplan, R. W. Bowes, C. F. Leland, A. Zeamans, George J. Woehrlin and E. A. Pierce.

**Heating and Sanitary Engineers' Association,** Seattle, Wash., has moved its executive offices from 4129 Arcade Building to 232 Securities Building.

**C. W. Wanger,** president of Woodward-Wanger Co., Philadelphia, has been elected a director of the National Trade Extension Bureau.

**Charles Stewart,** of the Hoffman Specialty Co., New York, has made a business trip through the South, visiting New Orleans, and spending some time with Hoffman Specialty Company's salesmen in that territory.

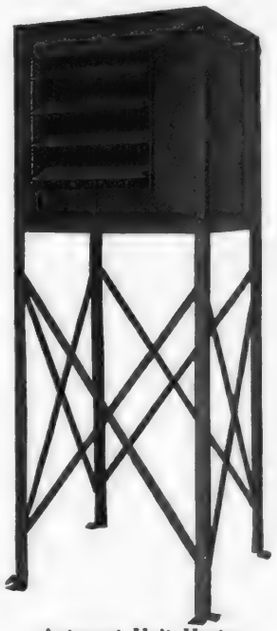

*Instant Heat—Always!*

with

AUTOVENT

Guaranteed

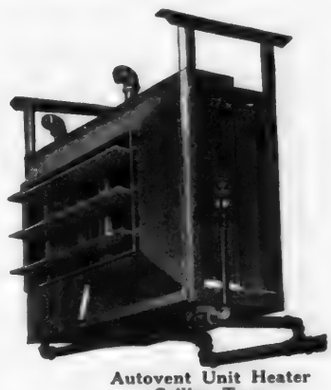
UNIT HEATERS



Autovent Unit Heater
Floor Type

*Here's Why*

**Heavy-duty motor . . . specially designed fan wheel . . . extra large size pressure chamber . . . tapered discharge . . . positively guaranteed performance . . . unusually careful and finished workmanship throughout . . . built for continuous duty.**



Autovent Unit Heater
Ceiling Type

*Unusual Record Established*

IN the four years that we have been building Autovent Unit Heaters, *not a single one* has ever failed to give satisfactory service!

This is a great record of which we are justly proud. It fully convinces us that it pays in added friendship and goodwill to build our product *right.*

You will be figuring on many Unit Heater jobs this fall. Let us work with you. If you haven't our catalog and prices—write!

AUTOVENT FAN & BLOWER CO.

1805-1827 N. Kostner Ave., Chicago, Ill.

**Joseph Fitts,** assistant secretary of the Heating and Piping Contractors National Association, was the guest of honor at a recent meeting of the Minneapolis chapter of the association, when he outlined the work being done by the national association. J. T. Braun, secretary of the Chicago association, reported on the work being done in Chicago.

## Manufacturers' Notes

**Bayley Blower Co.,** Milwaukee, Wis., a new corporation, has acquired by purchase all the assets of the Bayley Mfg. Company, comprising plant, equipment, patents, patterns, drawings, records and good-will. It is proposed to continue the manufacture and sale of the established Bayley lines, and the engineering, design, and service end of the business will be under the leadership of those formerly responsible for it.

Special attention will be given to the development of leather dryers, continuing their wet stock and seasoned leather dryers as well as loft dryers. There also will be built heating, ventilating and air conditioning apparatus, blowers for forced and induced draft, shavings, exhaust fans, etc.

**Hoffman Heater Co.,** Louisville, Ky., has opened a branch office and warehouse in Tulsa, Okla., with Barney McConnell in charge. The new branch will include the state of Oklahoma, and part of southern Kansas and western Missouri.

**Earle Gear and Machine Co.,** 4707 Stenton Ave., Philadelphia, Pa., announces the opening of a New York district office at 95 Liberty Street, with C. N. Walsh and George E. Barrett in charge. The company also maintains a district office at 110 State St., Boston, Mass., in charge of William H. Allen.

**Fitzgibbons Boiler Co.,** 570 Seventh Ave., New York, announces the addition of C. C. Lees to the sales organization of its recently-opened Philadelphia office.

**Winslow Boiler and Engineering Mfg. Co.,** Chicago, announces that H. J. G. Rudolf, chief engineer, is in charge of the Galesburg, Ill., plant of the company, succeeding R. D. DeWolf and H. A. Tedman, superintendent and factory manager, respectively. The plant is producing oil burners and has opened a new research department in charge of L. P. Arms, of Chicago.

**Rome Brass Radiator Corp.,** 1 East 42nd St., New York, has appointed Thomas E. Crone as district manager of the metropolitan area. Mr. Crone was for many years sales manager in this district.

**L. J. Wing Mfg. Co.,** New York, has appointed A. D. Foster, Missouri National Bank Bldg., St. Louis, to handle its line of unit heaters, forced-draft blowers, fans, exhausters, etc., in that territory.

**Niagara Blower Co.,** Buffalo, N. Y., announces that Claude A. Bulkeley has been appointed chief engineer, and will have direct supervision over the design and installation of all air-conditioning equipment and general supervision over all air engineering work. Mr. Bulkeley, for the past 10 years, has been supervisory engineer of the mechanical experimental division of E. I. duPont de Nemours & Company, Wilmington, Del.

**Cook Electric Co.,** Chicago, announces that the Cook H junior pump is listed as standard by the Underwriters' Laboratories. Other products manufactured by the company, namely, the Cook antisyphon valve and visible strainer, likewise have been listed.

**Security Stove & Mfg. Co.,** Kansas City, Mo., has appointed H. F. Widdicombe, formerly with the Baker Steam Motor Power Co., at Pueblo, as manager of the Oil Burner Division of the company.

**McArdle & Cooney, Inc.,** 519 Arch St., Philadelphia, Pa., has acquired the assets, stock, quarters and good-will of the Philadelphia branch of the Walworth Company, and has secured the exclusive rights to the distribution of Walworth products in that territory. For some time the acquired branch at 241 Arch Street and the warehouse at Washington Avenue and Front Street will be maintained, but later the business of the companies will be consolidated at 519 Arch Street.


# Announcement

DE BOTHEZAT IMPELLER CO., Inc., MANUFACTURERS of the "DISC PRESSURE FAN unsurpassed", in contemplating further expansion of its organization requires several experienced men to take charge of District Offices as DIRECT FACTORY REPRESENTATIVES. Men acquainted in the INDUSTRIAL FIELD preferred. Write, giving experience.

**DE BOTHEZAT IMPELLER CO., Inc.**

**1922 Park Avenue** **New York City**

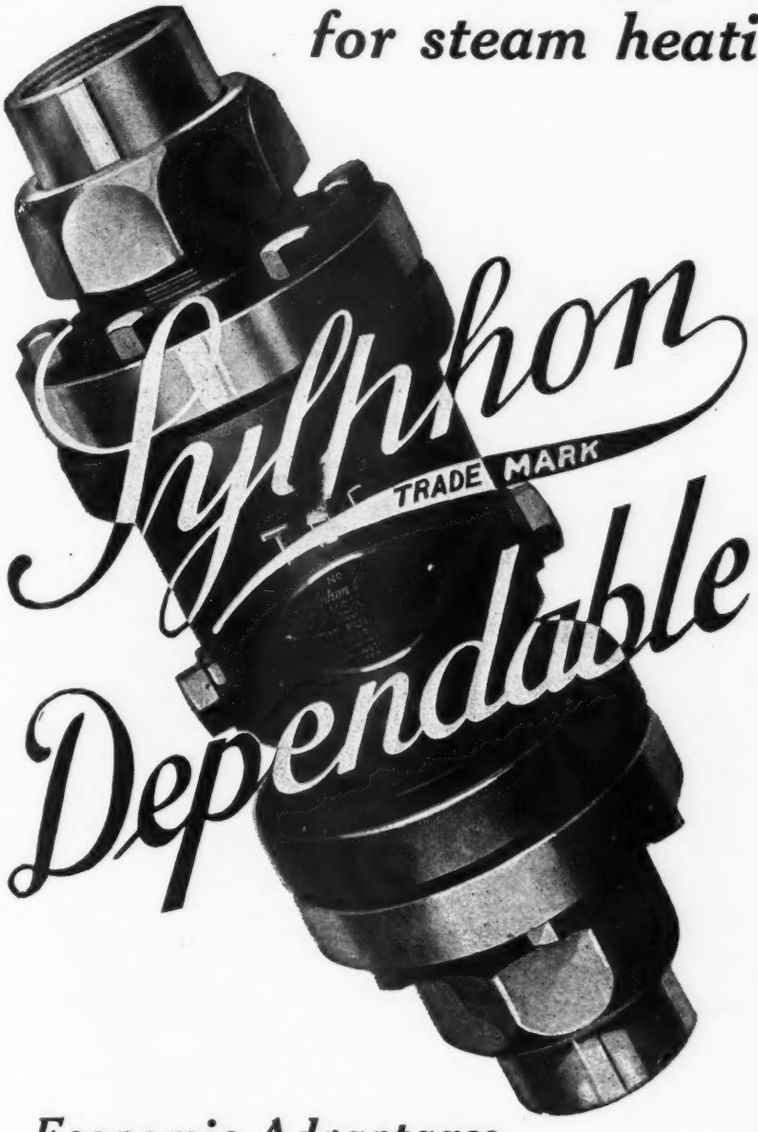
**Overcomes Duct Resistance.**

**Develops Static Pressure.**

**"THE PRESSURE FAN Unsurpassed"**

# SYLPHON PACKLESS EXPANSION JOINT

## *for steam heating risers*




## They Have To Be

**Dependable—**
**Steam Tight—**
**Free from Jamming Risk**

## *Because*

they contain the well-known seamless, all-metal Sylphon Bellows (recognized as the most durable, sensitive expansion unit known to science) which acts as a continuous flexible barrier against the escape of steam. Steam-tight at all times, requires no attention, yet has perfect freedom of motion without risk of jamming.

## *Economic Advantages*

Sylphon Expansion Joints obviate the costly assembling of large expansion loops on the job. They are less costly and much easier to install, and eliminate the damaging strains on pipe work and tapping of radiator branches.

The Fulton Sylphon Bellows is your guarantee. Investigate the economic advantages of this Packless Expansion Joint for your requirements. Send for Bulletin WEJ-100 containing full data, prices and shipping weights.

This can be done hundreds of thousands of times—
AND NO APPRECIABLE LOSS OF FLEXIBILITY WILL DEVELOP IN THE ALL METAL, SEAMLESS SYLPHON BELLOWS
Sylphon

# The Fulton Sylphon Company

*Originators and Patentees of the Sylphon Bellows*

Knoxville, Tennessee, U.S.A.

Sales Offices: New York, Chicago, Detroit, Boston, Philadelphia and all the principal cities in U. S. European Representatives: Crosby Valve & Engineering Co., Ltd., 41-42 Foley Street, London, W. 1, England. Canadian Representatives: Darling Bros., Ltd., 120 Prince Street, Montreal, Canada.

**Convention of Silent Glow Oil Burner Distributors, Hartford, Conn.**

## Silent Glow Representatives Meet in Convention

One hundred and forty dealers, handling the Silent Glow oil burner, with guests of the company, met at the factory, in Hartford, Conn., August 10, discussed the salient features of the coming campaign, and later participated in a sheepbake in Goodwin Park.

The new equipment, a cook stove and a heating stove, in which Silent Glow burners are used, were exhibited, together with the Silent Glow Bullseye water heater.

At the sheepbake the visitors were welcomed by W. H. Corbin, representing the Chamber of Commerce, and addressed by F. K. Daggett, president of the Hartford Oil Dealers' Association. P. E. Fansler, associate editor, THE HEATING AND VENTILATING MAGAZINE, spoke on "How to Decrease Sales Resistance Through Truthful Presentation of the Oil-Burner Story." J. L. Bauer, president of the corporation, presided. Fifty automobiles, carrying the delegates, made a tour of the park and residential section of Hartford.

**Cleveland Gas Burner & Appliance Co.,** Cleveland, O., announces the appointment of O. P. Simler, formerly vice-president and general sales manager of the Hoffman Heater Company, as general sales manager of the company. Mr. Simler has been identified with the heating trade for the past 27 years.

## Business Mergers

**Power Specialty Co.,** Chicago, and **Wheeler Condenser & Engineering Co.,** New York, have consolidated under the new name of Foster Wheeler Corp., 111 Broadway, New York. Foster, Wheeler and Aero products will be continued. This combination of non-competitive interests, operating in the same fields, it is expected, will effect material economies to owners and purchasers of auxiliary power plant equipment and oil refinery apparatus. The management of the new corporation will remain in the hands of those executives and engineers who have been responsible for the development of the products and organizations for more than 20 years.

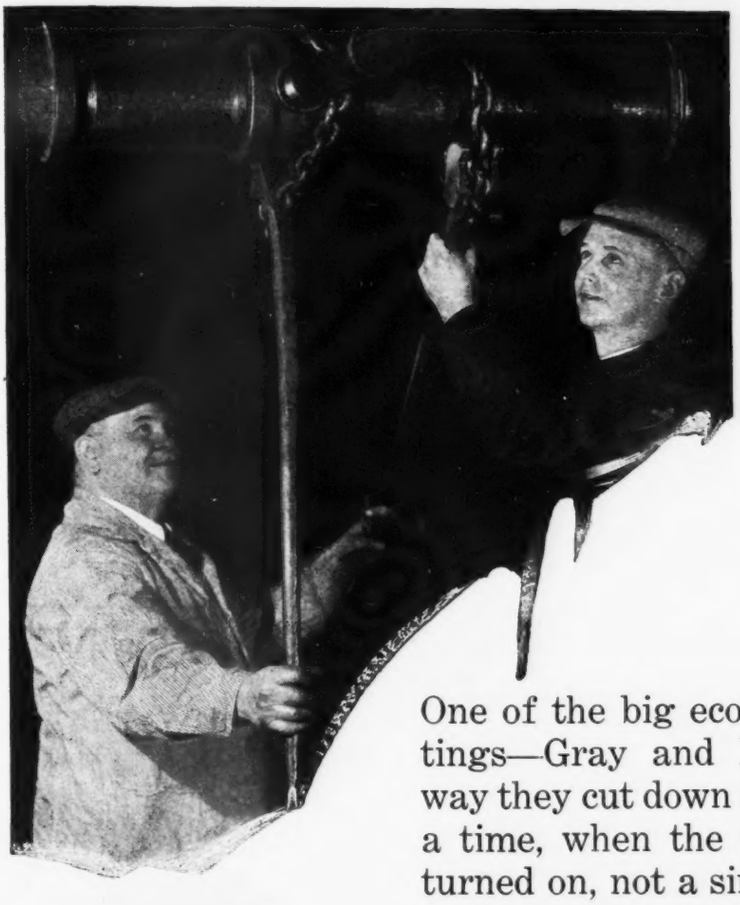
YEOMANS
YEOMANS PUMPS • GIVE YEOMAN SERVICE •
HORIZONTAL AND VERTICAL AUTOMATIC ELECTRIC
Condensation Pumps
A thorough investigation of this pump will reveal the best material, the finest workmanship, resulting in a noiseless, rugged, reliable product that will give dependable service for many years.
For automatically returning condensation to boilers from low pressure gravity steam heating systems.
Also manufacturers of Bilge Pumps, Centrifugal Pumps, Sewage Ejectors, Sewage Pumps, etc.
Engineers and architects may for the asking receive our condensation bulletin.
YEOMANS BROTHERS COMPANY
1421 Dayton St., Chicago
Representatives in all principal cities
9

E Z
RADIATOR HANGER
THE good word is spreading. Every woman appreciates legless radiators because there's nothing to interfere with mop or sweeper. Clear floors are easy to clean!
E-Z Hangers require only one bolt per hanger. They are adjustable both laterally and vertically. Anchor bolt does not require accurate placing. Adapted to any wall, any legless radiator. Use these better hangers.
For all makes of Radiation, including Aero, Corto, Eastwood, etc.
½" PIPE
Style R
HEALY-RUFF CO.
772 Hampden Avenue
ST. PAUL, MINN.

[redacted]

*Jim* (who is something of a pessimist): "Now that we've got the plagued system hooked up, I wonder how many sand holes we'll find when we test it out."

*Old Timer*: "We're in luck, Jim. They sent us Grinnell stuff this time. Didn't you see the big 'G' on the fittings? Sand holes seem as scarce as cow-feathers in those castings."



*The Old Timer Knows*

One of the big economies of Grinnell Fittings—Gray and Malleable Iron—is the way they cut down installation costs. Many a time, when the water, steam, or air is turned on, not a single section of pipe has to be backed out to put on a new fitting. Their freedom from sand holes is extraordinary. See for yourself—by using Grinnell Fittings on your next job. If your jobber hasn't them in stock write for the name of the nearest distributor. Address Grinnell Company, Inc., 208 West Exchange St., Providence, R. I.

**GRINNELL**
PIPE FITTINGS

***Cast Iron Fittings—Adjustable Pipe Hangers***

# GRINNELL

***Pipe Bends—Welded Headers—Lap Joints—Piping Supplies***

**Crane Co.**, Chicago, Ill., has purchased the land adjoining its Newark, N. J., branch at 90 South Street, for the purpose of erecting a larger pipe yard to provide for increase in business.

## Changes of Address

**Wayne Co.**, San Francisco, Calif., announces the removal of its office and display room to the Chronicle Bldg., at 911 Mission Street, with warehouse facilities in the Hawley Terminal Bldg., at 274 Brannan Street.

**Wyckoff & Lloyd Co.**, Springfield, Mass., has moved from 19-27 Worthington Street to a 3-story building at Columbus Avenue and Emery Street, which recently was bought and remodeled for its use.

**Fairbanks Co.**, 416 Broome St., New York, is moving its main offices and warehouse to 393-399 Lafayette Street.

# WANTED

**Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.**

**SALESMAN WANTED**—Salesman for Newark, N. J., and vicinity. Must be heating sales engineer. Desire man with acquaintance among wholesalers. Address Box 96, care of Heating and Ventilating Magazine.

**WANTED**—Man in consulting engineer's office to make electrical plans and specifications and supervise installation of electrical work. State qualifications and salary required. Address Box 97, care of Heating and Ventilating Magazine.

**SALES ENGINEERS WANTED**—Old established company, manufacturing high-grade vapor heating specialties, has some territories open at the present time. Write if you are interested in selling this line on a commission basis. State territory and other lines. All communications held strictly confidential. Address Box 91, care of Heating and Ventilating Magazine.

**WANTED**—Man experienced in making heating plans and estimating cost of same, having connections with possible clients. State qualifications fully and salary expected. Address Box 92, care of Heating and Ventilating Magazine.

**SALESMAN WANTED**—Salesman for Ohio and Western Pennsylvania. Must be heating sales engineer. Prefer man who is familiar with gas-fired boiler. Address Box 93, care of Heating and Ventilating Magazine.

**DISTRIBUTORS WANTED**—Pump manufacturer wants additional distributors for a complete line of high-grade centrifugal pumps, including a large number of specials for the heating and plumbing trade, as well as water works pumps, boiler feeders, etc. Only aggressive men with excellent personal and business reputations will be considered. All communications strictly confidential. Address Box 94, care of Heating and Ventilating Magazine.

**MANUFACTURER'S REPRESENTATIVE—Manufacturer of complete line of fans, air washers and unit heaters, desires recognized representatives on commission basis. Address Box 95, care of Heating and Ventilating Magazine.**

## BUILD YOUR FUTURE ON SOLID GROUND

—through our complete and masterful instruction and personal guidance.

The **technical** man wins. After all, success is application, properly directed. This hits you right between the eyes! Turn the hours you spend **non-productively** into **real productive** hours. Let us guide you in a course of home-study, easily and comprehensively laid out, **that will not fail to bring you to the very top of your chosen field! Foremanship! Ownership! Real success! It lies with you, and you alone!** Check and mail us the craft you wish to master and we will send you full information as to how we can increase your earning power from three times on. There's no **limit!**

- ☐ Heating and Ventilating Engineering.
- ☐ Special Steam and Water Heating.
- ☐ Scientific Warm Air Heating.
- ☐ Plumbing and Sanitary Engineering.
- ☐ Contracting and Estimating.
- ☐ Mechanical Drafting.

Saint Louis Technical Institute
*Est. 1910*

**The most thorough institution for Technical Home Study to-day.**

4543 Clayton Ave. St. Louis, Mo.

# HEAT— *Where It's Wanted When It's Wanted*

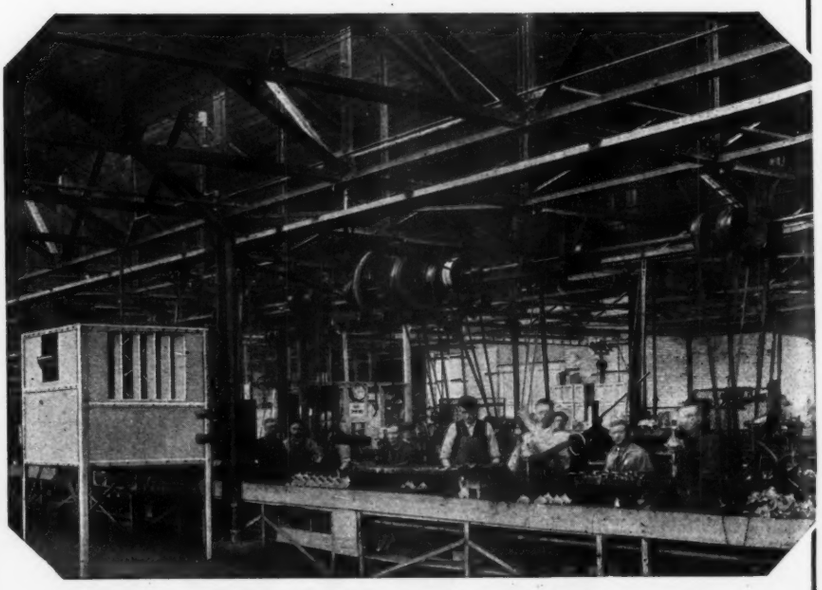
## At a Big Reduction in Cost

Twin Fan Unit Heaters make possible almost as complete control of the temperature of a plant as there is of its lighting, and do it at a big saving in fuel costs and floor space.

The indirect radiation system of the Twin Fan Units keeps the heat away from the ceilings, drawing it down to the level of the workers where it is required—thus eliminating one of the biggest sources of fuel waste.

Any part of a building can be heated independently of any other part. With Twin Fan Unit Heaters it is simply a matter of switching on the heat when and where it is wanted and switching it off when and where it is not wanted. Twin Fan Unit Heaters also make a complete, perfectly controlled ventilating system.

Ask us for the names and addresses of the industrial plants and garages where Twin Fan Unit Heaters have set new standards in heating efficiency and economy.



*By selling your customers Twin Fan Unit Heaters you build up a profitable REPEAT ORDER business. Let our engineers help you on your next heating job.*

**DWYER EQUIPMENT COMPANY**
**4534 W. NORTH AVE. CHICAGO, ILL.**